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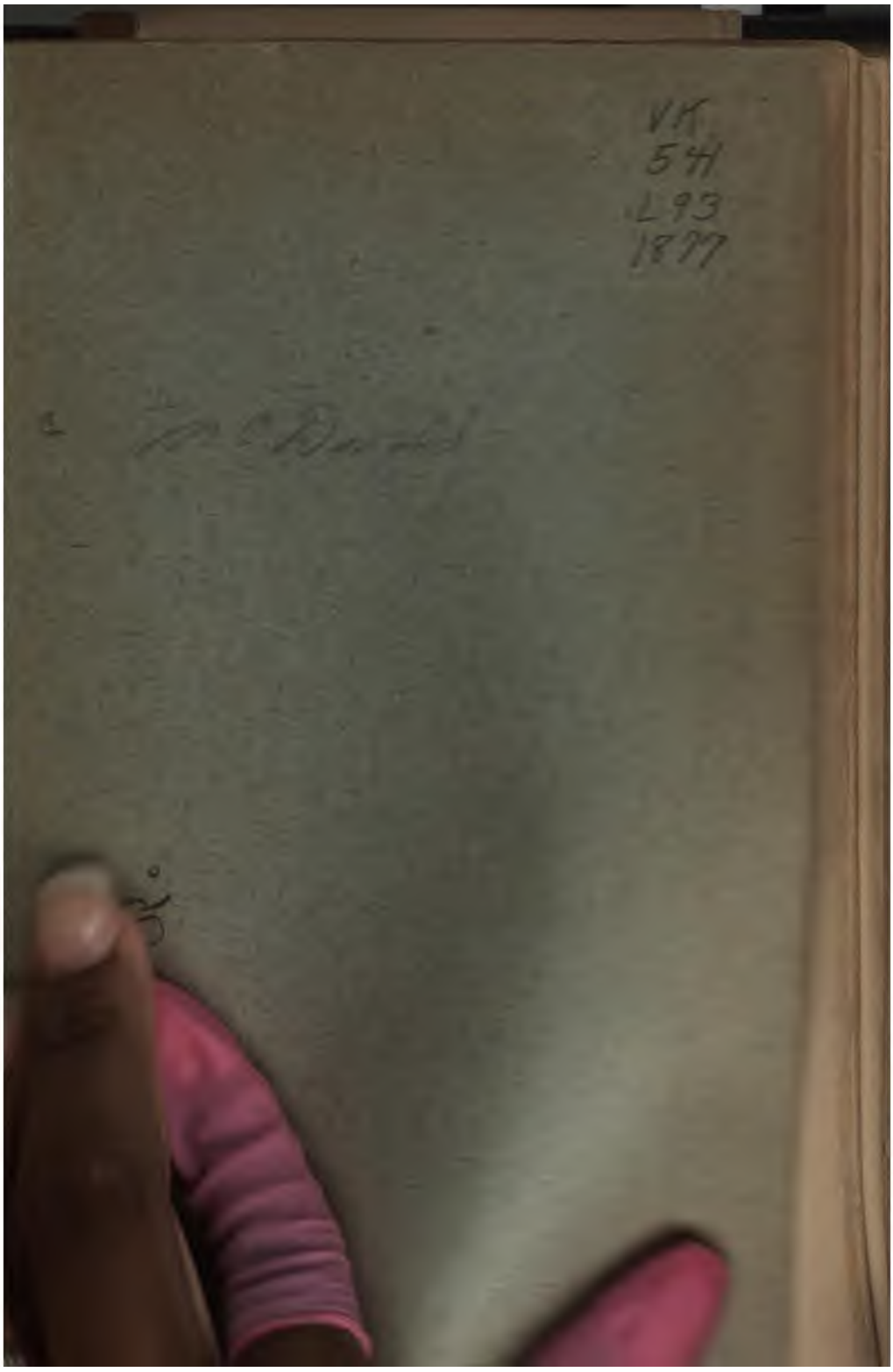
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SEAMANSHIP:

COMPILED FROM VARIOUS AUTHORITIES,

AND

Illustrated with Numerous Original and Select Designs,

FOR THE USE OF THE

UNITED STATES NAVAL ACADEMY,

By S. B. LUCE,

LIEUTENANT-COMMANDER, UNITED STATES NAVY.

Sixth Edition—Revised and Enlarged.

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D. VAN NOSTRAND,

In the Clerk's Office of the District Court of the United States for the Southern District of New York.

RESPECTFULLY DEDICATED

TO

REAR-ADMIRAL SAMUEL F. DUPONT,

UNITED STATES NAVY.

• • • • • • "The battle over, the fleet must, or should, pass from steaming to sailing, in order to economize fuel, which may be wholly or nearly exhausted during the action; the like expenditure of fuel may have taken place in the enemy's fleet, and this, together with the dismantling effects produced upon the rigging of his ships, will impede or prevent his escape. Both sailing and steaming power, in the same ship, must therefore be always kept in a state of efficiency. In the early day of steam propulsion, it was imagined by Paixhans and others, that a few small steamers, with little or no sailing power, might destroy or capture any ship if properly attacked on her weak points; and this is true in calms, and of operations in inland seas and waters, in which fleets of large ships of war can neither manœuvre, nor follow vessels of small draught of water into shallow creeks or channels. But for steam-warfare on the ocean, ships must be rigged and equipped with full sailing power, and, consequently, fully manned with able seamen as before; and thus, nautical skill and good practical seamanship will be as necessary as ever to steam-fleets, *and will continue to tell, as heretofore, in favor of that party which is most proficient in nautical skill and expert seamanship.* It must not, therefore, be assumed, in preparing for steam-warfare, that the sail will be entirely supplanted by steam, or that steam ...ts may dispense with crews of able seamen."

[*Sir Howard Douglas'* "*Naval Warfare with Steam.*"]

PREFACE TO THE THIRD EDITION.

THE publication of the Regulations for the Government of the United States Navy obviates the necessity of treating of "Routine" and "The Duties of Officers" in this edition; and as one of the other Departments of the Naval Academy will hereafter give all necessary instruction in the principles involved in the "Theory of Working Ship," all the second part of the former edition is omitted in this. Nevertheless, to supply the place of the portions omitted, there have been added two or three chapters on subjects deemed essential to the course of study of Seamanship, as now pursued. The work has been very largely revised, and considerable additions made to the original text.

STEPHEN B. LUCE,
Lieut.-Com. U. S.

U. S. NAVAL ACADEMY,
May, 1866.

PREFACE.

THIS work has been compiled for the use of the midshipmen at the Naval Academy, and it is hoped that, as it may save them much copying of manuscript, formerly an onerous task, it may prove acceptable.

In the general arrangement of the work the compiler has been controlled by the following considerations :

First, That, for the present at least, the introduction of Steam and Iron-Clads into the Navy, in no degree lessens the necessity that Naval Officers should be practical seamen, skilful in the management of ships under canvas, and fertile in all the resources known to seamen, as well as prompt in the application of them, when meeting the accidents and disasters incident to men-of-war.

Secondly, That, during the regular course of study at the Academy, the midshipmen may be regarded as passing through, and acquiring a knowledge of the duties of, three different grades, namely, those of SEAMEN, PETTY OFFICERS, and LIEUTENANT ; in the last capacity being required to take charge of a watch and a division of great guns.

Thirdly, That proficiency in seamanship is to be acquired only on the deck and in the tops of a sea-going Man-of-war, or such Practice Ships as are now, by a wise provision of the Navy Department, attached to this Academy—not from drawings or models, or a text-book, such as this, which is intended merely as a guide for observation and instruction.

Finally, That instructors may prefer to omit some portions altogether, or to supply omissions of the compiler by the suggestions of their own experience.

The chapter embracing the "Theory of Stowage," as extracted from Boyd's "Naval Cadet's Manual," was allowed to run into the subject of "Construction," for want of a proper text-book on Naval Architecture; a deficiency which, it is hoped, may soon be supplied.

The work was originally designed to combine the excellent instructions in "Evolutions" of "Totten's Naval Text-Book," with the equally admirable compendium of "Spars and Rigging," contained in Murphy's "Nautical Routine;" but the necessities of the subject led to expansion into other branches of Seamanship.

The grateful acknowledgments of the compiler are also due to the following works, from which he has not hesitated to make numerous extracts, viz.:

Seamanship and Naval Duties, by Lieut. A. H. Alston, R. N.
The Naval Cadet's Manual, by John McNeill Boyd, Captain R. N.
Seamanship, by Lieut. G. S. Nares, R. N,
The Naval Officer's Manual, by W. N. Glascock, Captain R. N.
Professional Recollections on Seamanship, Discipline, &c., by Captain Francis Liardet, R. N.
The Sheet Anchor, by Darcy Lever, Esq.
An Inquiry relative to various important points of Seamanship, by Nicholas Timmouth, Master Attendant, Dock Yard, Woolwich (England).
The Rigger's Guide, by Charles Bushell, H. M. Dock Yard, Portsmouth.
The New American Cyclopædia, Ripley and Dana.
The Encylopædia Americana.
The Theory and Practice of Seamanship, by Edmund M. Blunt.
Cooper's Naval History.
Ordnance Instructions for the U. S. Navy.
Bowditch's Navigator.
Autobiography of Lord Dundonald.
The Anchor Watch, by a Master Mariner.
Naval Architecture, by Creuze.
Tactique Navale.
Griffith's Naval Architecture.

To these may be added a few rough notes furnished in manuscript by former instructors.

STEPHEN B. LUCE,
Lieut.-Com'r, U. S. N.

NAVAL ACADEMY, *Newport, R. I., Feb.*, 1863.

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PLATE 1

Fig. 4

Fig. 3

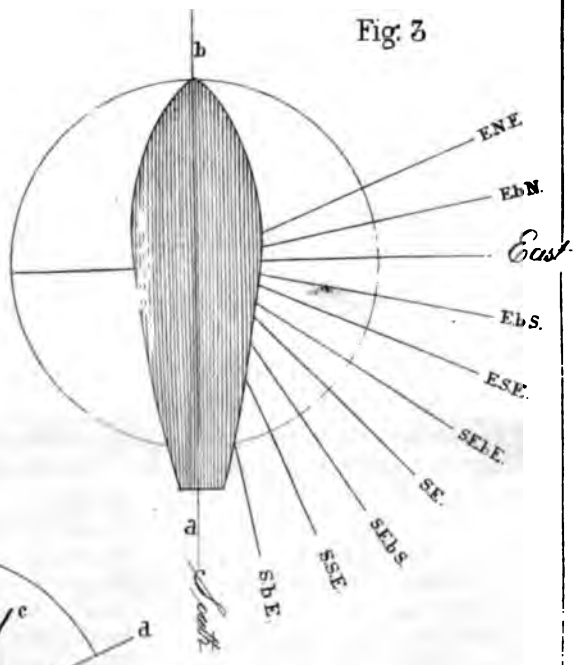


Fig. 2

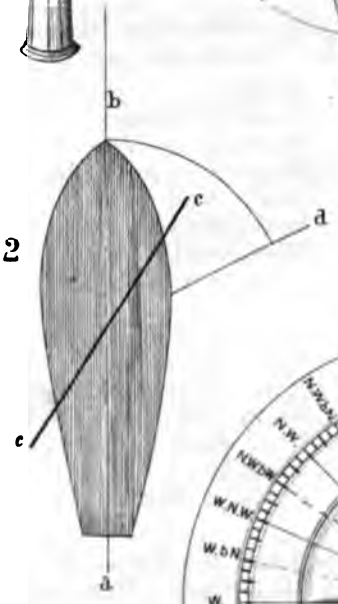


Fig. 1

SEAMANSHIP.

CHAPTER I.

THE COMPASS—THE LEAD.

To Box the Compass is to name the points in regular succession, beginning at one point and ending at the same; thus commencing with north and going around *with the sun*, say:

North,	South,
North by East,	South by West,
North North-East,	South South-West,
North-East by North,	South-West by South,
North-East,	South-West,
North-East by East,	South-West by West,
East North-East,	West South-West,
East by North,	West by South,
East,	West,
East by South,	West by North,
East South-East,	West North-West,
South-East by East,	North-West by West,
South-East,	North-West,
South-East by South,	North-West by North,
South South-East,	North North-West,
South by East,	North by West,

North.

Each point is divided into quarters and the fractional parts are thus expressed: East by South, a half South; West, a quarter North, &c.

A square-rigged vessel when close hauled (i. e., as close to the wind as she can lie), can approach no nearer to it than six points; to the perfect understanding of which the young sea officer must make himself thoroughly acquainted with the Mariner's compass, which should be got by heart, that he may refer to it in his memory on all occasions.

The compass is described on a card like Fig. 1, Plate 1, divided in several points; and this card being fixed on a piece of

steel called the *Needle*, which has been touched by a load-stone, acquires the property, when resting on a pivot fixed vertically in the compass-box, of pointing to the north. The north point of the compass then pointing to the north, the others will, of course, point to their respective parts of the horizon. The variation of the compass and its local deviation are not here noticed, as they may be referred to in any book of navigation.

The compass has eight points in each quarter, equal to ninety degrees, making in the whole, thirty-two, equal to three hundred and sixty degrees of the horizon. A square-rigged ship, when close hauled (as before mentioned), can lie no nearer to the wind than six points: therefore, if a ship be close hauled on the starboard tack, and her head at north, count six points from thence to the right hand, or towards the east, and you will find the wind must be at E. N. E. The wind then forms an angle with the keel of six points, or sixty-seven degrees and thirty minutes; so that if the line (a b) Fig. 2, Plate 1, represents the ship's keel, (c) will be the yard when braced up, and (d) the direction of the wind. In practice, the yard is braced up sharper, to make the sail stand to the most advantage.*

The *Lubber's Point* is a vertical line drawn on the inside of the bowl of the compass, to correspond with the vessel's head; the point of the card coinciding with it shows the course steered.

When the wind is at E. by N., Fig. 3, Plate 1, she has then one point free; because she is seven points from the wind. When at east, which is eight points from north, it is said to be a-beam. It then blows on the ends of the ship's beams, which lie athwart her, and in lines perpendicular to the keel (a b). E. by S. is one point abaft the beam, E. S. E. two points, S. E. by E. three points abaft the beam.

When the wind is at south, it is *right aft*, and the ship is then before the wind. When at S. by E. it is one point on the quarter; S. S. E. two points on the quarter, S. E. by S. three points, and when at S. E. it is said to be *on the quarter*.

When the ship is on the port tack, with her head north, the points are counted on the opposite or west side; and if the ship's head be put to any point of compass, the distances will be the same; for, by looking at the compass, Fig. 1, and counting the points to the right or left hand, according as the ship is on the starboard or port tack, you may always find how the wind is with respect to the ship's keel.

* Modern ships in a whole-sail breeze and smooth sea can brace their yards so as to lie within *five points* of the wind.

THE LEAD.

After learning to box the compass with the sun, go around against the sun or from north towards west, and practise with such questions as the following: Ship on the port tack, heading S. W. $\frac{3}{4}$ W., how will she head on the other tack? With the wind at S. W. and steering due east, the ship is hauled up two points and a half, how will she head? Close hauled, with the port tacks aboard, heading S. S. E., you *bear up*, keeping away six points, how will the ship head, and how will the wind be with reference to the ship's beam? Ship heading N. N. E. on the starboard tack, a light-house is reported from aloft bearing two points abaft the lee beam, how will it bear by compass, &c., &c.

A *dumb-compass* is used at the mast-heads, taffrail, &c., for taking *relative* bearings. It consists of a compass-card painted on a board or cut on a copper-plate.

THE LEAD.

Soundings, to ascertain the depth of water on entering or leaving a port, or in any case where there is supposed to be less than twenty fathoms of water, are taken by the *hand lead*, a quarter-master or forecastle-man being stationed in the main chains for the purpose; the lead weighing from seven to fourteen pounds, and the line being from twenty to thirty fathoms in length.

Soundings at sea, in a greater depth than twenty fathoms, are taken by the use of the *deep-sea lead*, which weighs from forty to one hundred pounds, the line being from eighty to one hundred fathoms in length. Fig. 4, Plate 1.

Both the hand and deep-sea lines are marked as follows:

At	2	fathoms	from	the lead,	with 2 strips of leather.
"	3	"	"	"	" 3 " "
"	5	"	"	"	" a white rag.
"	7	"	"	"	" a red rag.
"	10	"	"	"	" leather, having a hole in it.
"	13	"	"	"	as at 3.
"	15	"	"	"	as at 5.
"	17	"	"	"	as at 7.
"	20	"	"	"	with two knots.
"	25	"	"	"	" one knot.
"	30	"	"	"	" three knots.
"	35	"	"	"	" one knot.
"	40	"	"	"	" four knots. And so on.

These are known as the "marks." The numbers omitted, as 1, 4, 6, 8, &c., are called the "deeps," and they are spoken of together as the "marks and deeps of the lead-line."

THE LEAD.

In marking the deep-sea line, the first marks before twenty fathoms may be omitted, with the exception of the ten-fathom mark, and, if you please, the fifteen, as directed above.

Soundings by the hand-lead are taken while the vessel has headway on, the leadsman throwing the lead forward, and getting the depth as the vessel passes, while the line is nearly perpendicular. He communicates to the officer the soundings obtained, thus:

If the depth corresponds with either of the above marks, he says, "*By the mark* 5 *or* 7." If the mark is a little below the surface, he says, "*Mark under water* 5 *or* 7." If the depth is greater, or one half more than any of the marks, he says, "*And a quarter*," or "*And a half* 5 *or* 7." If the depth is a quarter less, he says, "*Quarter less* 5 *or* 7." If he judges by the distance between any two of the marks that the depth of water is 4, 6, 8, 9, 11, 12, 14, 16, 18, 19, or 21 fathoms, he says, "*By the deep* 4," &c.

On the hand-lead line there are nine "marks" and eleven "deeps."

Instead of the "song," some officers prefer the Coast-survey practice, and require the soundings to be given in a sharp, clear and decided tone of voice. In steamers, this is certainly the best plan, for while the old-fashioned "song" is being drawled out, the vessel may run ashore.

The Breast-band or Rope, generally the former, made of canvas, secured at both ends to the rigging, supports the body of the leadsman while heaving the hand-lead.

Besides the breast-band, it is a very good plan to have fitted, in connection with it, a tarpaulin apron, to cover the "leadsman" from the feet to the waist. This keeps him dry and adds much to his comfort.

On going into the chains for the purpose of sounding, the leadsman should see the breast-rope properly secured; his line clear, and the end made fast. If at night, he should take the distance from the breast-rope to the water's edge; then at each cast deduct this distance from the mark at hand and give it as the true sounding.

To sound with the Deep-sea Lead. The men are made to range themselves outside of the vessel, from the weather mizzen chains to the cathead. The end of the line is passed forward, outside and clear of everything. The lead, armed with tallow at its base, is sent forward to the forecastle, where it is the duty of the captain of the forecastle to secure it to the end of the line. The

THE LEAD.

line is then hauled forward, each man collecting a coil of several fathoms in his hand, commencing forward, until the officer thinks there is line enough out. *All ready forward!* being communicated from the forecastle, the vessel is luffed up into the wind until her headway is sufficiently deadened. Or, as is advisable in a good breeze, the main or mizzen topsail is braced aback. The line is then snatched in a small snatch-block, secured to the after mizzen rigging, or to the weather spanker vang, the remaining part of it being coiled down in a tub or rack, or on a reel, clear for running. Everything being in readiness, and the vessel's headway sufficiently deadened, the officer orders, *Stand by! Heave!* The captain of the forecastle, or whoever holds the lead, heaves it as far forward as he can, and at the same time cries, *Watch-ho! Watch!* And each man, as the line runs out from his hand, holds it clear of the side, and repeats the cry, *Watch-ho! Watch!* In the mean while, the line runs out until the lead touches the bottom, or until a sufficient quantity has been run out to satisfy the officer that no bottom has been found. The men then *lay aft and man the line!* and walk forward with it; a petty officer being stationed by it, to note the depth of water by the first mark that comes in.

If bottom has been found, it will instantly be known by the line bringing up suddenly in running out, or by the arming on the lead after it is hauled up; by which the nature of the bottom is known.

To get sounding by the deep-sea lead while lying to in a gale, or in any case when the vessel drifts much to leeward, it is proper to pass the line from to windward around the stern, and then forward on the lee side, and to heave the lead from to leeward, which will bring the line nearly perpendicular by the time the lead touches the bottom.

In heaving the deep-sea lead, the men stationed in the chains should be cautioned not to let the line go until they feel the lead take it, for if the ship is in much shoaler water than was anticipated, it is thus detected at once.

The depth of water, and the nature of the bottom, serve, like latitude and longitude, to fix a ship's position, and when approaching land, are often of the first importance to the navigator.

Besides the common lead there are a variety of "patents" for sounding; the one known as *Massey's lead*, being about the most successful. In this, a machine is attached to the lead, and a fan set in motion by its descent. The motion is communicated to a register wheel, and the number of fathoms corresponding to the

depth of water is pointed out by an indicator. This lead should also have a good arming of tallow to bring up specimens of the bottom.

The **Drift Lead.** While at single anchor, it is proper always to have a lead somewhat heavier than the hand-lead, say from fourteen to twenty pounds, over the side, and resting on the bottom, with a man to attend it. Of course, this is only necessary in a stiff breeze, or at night. But in a vessel-of-war, where you have many hands unoccupied, it is a prudent, and should be observed as a standing, rule, without regard to the weather. By this, you will have instant notice if the vessel parts her cable or drags her anchor.

PLATE 2

Fig. 5

Fig. 6

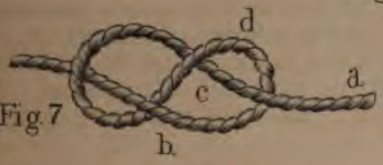


Fig. 7

Fig. 8

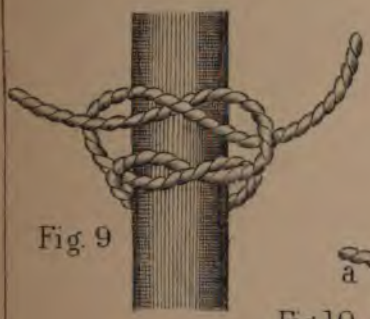


Fig. 9

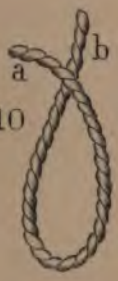


Fig. 10

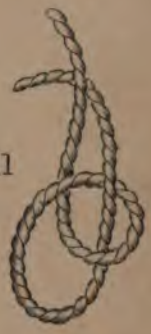


Fig. 11

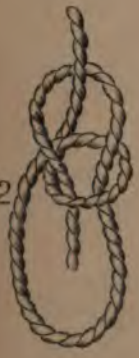


Fig. 12

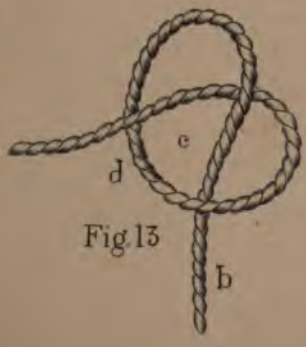


Fig. 13

Fig. 14

PLATE 3

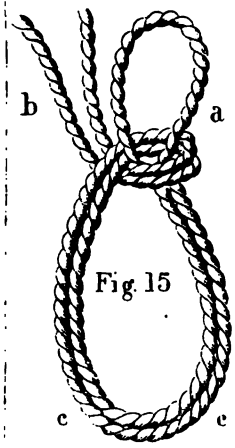


Fig. 15

Fig. 16

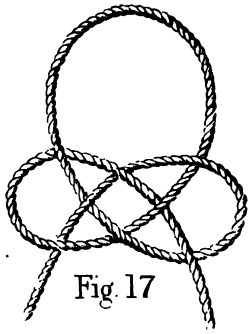


Fig. 17

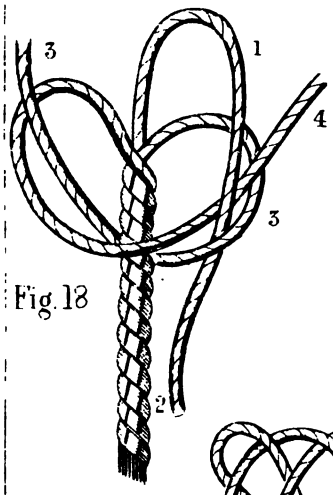


Fig. 18

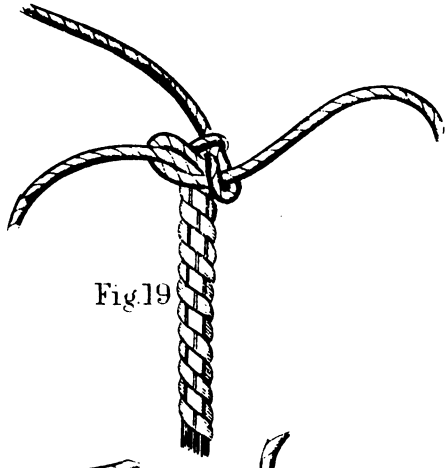


Fig. 19

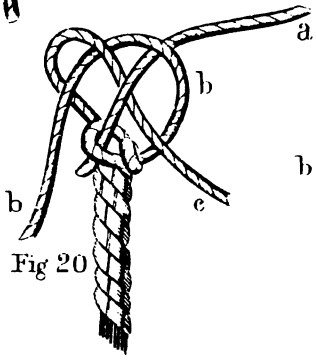


Fig 20

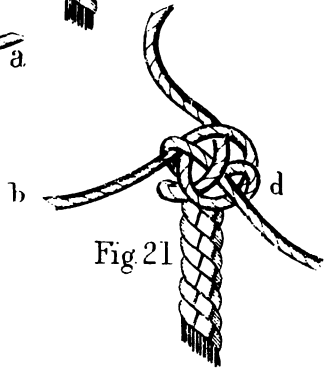


Fig 21

CHAPTER II.

KNOTTING, SPLICING, &c.

To Knot a Rope-Yarn, Fig. 5, Plate 2. Split in halves the two ends of a rope-yarn, scrape them down with a knife, crotch and tie the two opposite ends; jam the tie and trim off the ends.

An Over-Hand Knot, Fig. 6, Plate 2. Pass the end of a rope (b) over the standing part (a) and through the bight above (c).

A Figure-of-Eight Knot, Fig. 7, Plate 2. Take the end of a rope (a) round the standing part (b), under its own part (d), and through the bight (c).

A Reef Knot, Fig. 9, Plate 2. Make an over-hand knot, as before directed, Fig. 8, round a yard or spar; bring the end (a) being the next towards you over to the *left* and (b) to the right, take (a) round (b), draw them taut, and it is done, Fig. 9. This knot is used in tying reef points and small stuff generally. Observe to bring the end out next its own part, otherwise it will be a *Granny's Knot.*

A Bow-Line Knot, Fig. 12, Plate 2. Take the end of the rope (a), Fig. 10, in the right hand, and the standing part (b) in the left, laying the end over the standing part; with the left hand turn a bight of the *standing* part over it, Fig. 11; lead the end round the standing part, through the bight again, and it will appear like Fig. 12. The bight turned in the standing part is often called a *Cuckold's Neck.*

A Running Bow-Line Knot, Fig. 14, Plate 2. Take the end of a rope, Fig. 13, round the standing part (b) and through the bight (c); make the single bow-line knot upon the part (d), and it is done.

A Bow-Line Knot upon the Bight of a Rope, Fig. 16, Plate 3. Take the bight (a) in one hand, Fig. 15, and the standing parts (b) in the other; throw a kink or Cuckold's Neck over the bight (a) with the standing parts, the same as for the single knot; take the bight (a) over the large bights (c, c), bringing it up again: it will then be complete, Fig. 16. The best way to sling a man by a bow-line is to shorten up one of the lower bights, using the lower part as a seat and putting the arms through the part next above.

A Prolonge Knot, Fig. 17, Plate 3.

KNOTTING.

A Wall Knot. Unlay the end of a rope, Fig. 18, Plate 3, and with the strand (1) form a bight, holding it down on the side of the rope at (2); pass the end of the next (3) round the strand (1); the end of the strand (4) round the strand (3) and through the bight which was made at first by the strand (1); haul them rather taut, and the knot will then appear like Fig. 19.

To **Crown** this knot, Fig. 21, Plate 3. Lay one of the ends over the top of the knot, Fig. 20, which call the first (a); lay the second (b) over it, and the third (c) over (b), and through the bight of (a); haul them taut, and the knot with the crown will appear like Fig. 21, which is drawn open, in order to render it more clear. This is called a *Single Wall*, and *Single Crown*.

To **Double-Wall** this knot, Fig. 22, Plate 4. Take one of the ends of the single crown, Fig. 21, Plate 3, suppose the end (b), bring it underneath the part of the first walling next to it, and push it up through the same bight (d); perform this operation with the other strands, pushing them up through two bights, and the knot will appear like Fig. 22, having a *Double Wall* and *Single Crown*.

To **Double-Crown** the same knot, Fig. 23, Plate 4. Lay the strands by the sides of those in the single crown, pushing them through the same bights in the *single* crown, and down through the double walling: it will then be like Fig. 23, viz. *single* walled, *single* crowned, *double* walled, and *double* crowned. The first walling must always be made *against* the lay of the rope: the parts will then lie fair for the double crown; so that if Fig. 18, Plate 3, had been a plain-laid rope, or *with the sun*, the strands (1, 3, 4) would have been passed the contrary way. The ends are scraped down, tapered, marled, and served with spun yarn. This knot is often used for the ends of man-ropes, and hence frequently called a *Man-rope Knot*.

Matthew Walker's Knot, Fig. 25, Plate 4. This knot is made by separating the strands of a rope, Fig. 24, taking the end (1) round the rope, and through its own bight, the end (2) underneath through the bight of the first, and through its own bight, and the end (3) underneath, through the bights of the strands (1 and 2), and through its own bight. Haul them taut, and they form the knot, Fig. 25. The ends are cut off. This is a handsome knot for the end of a laniard, and is generally used for that purpose.

The knots are in general drawn very slack and open, that the parts may be more plainly displayed; on which account they have not so neat an appearance in the plates as when they are hauled taut. More bights and turns are also shown in the draw-

PLATE 4

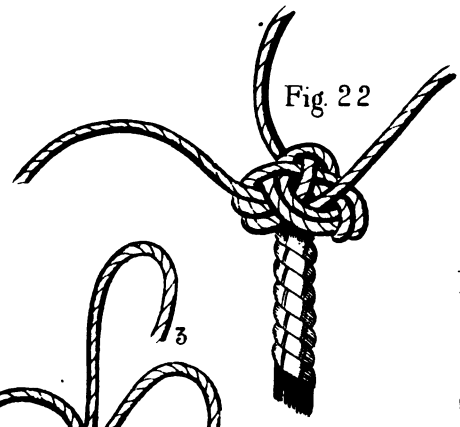


Fig. 22

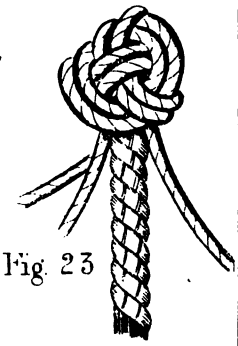


Fig. 23

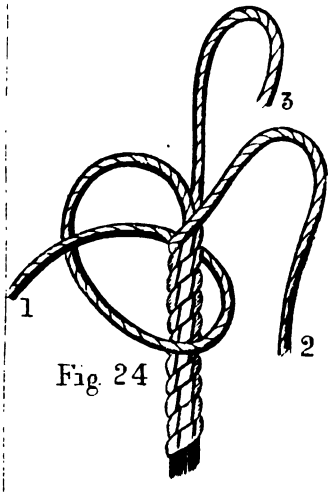


Fig. 24

Fig. 25

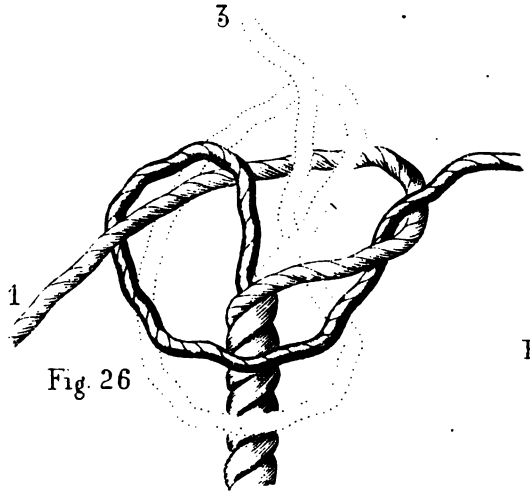


Fig. 26

Fig. 27

PLATE 5

Fig. 28

Fig. 29

Fig. 30

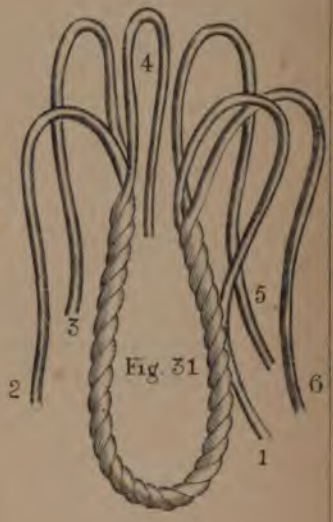


Fig. 31

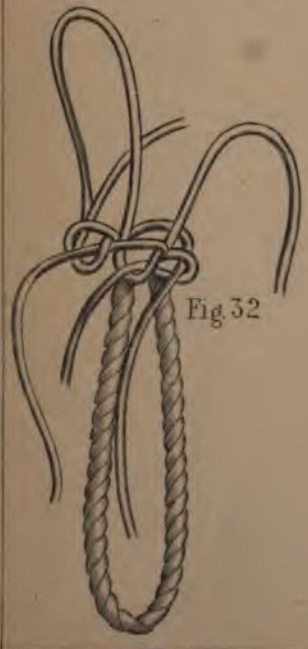


Fig. 32

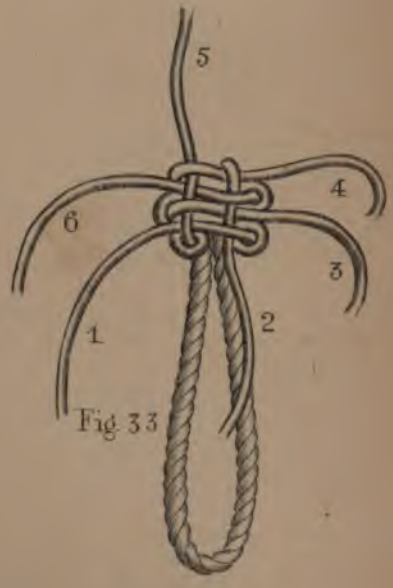


Fig. 33

ings than can be seen at one view in the knots without turning them backwards and forwards.

A Single Matthew Walker. With strands (1 and 2) form a Wall knot, omitting strand (3); then with strand (3) dip down, round all parts, and come out next its own part, Fig. 26, Plate 4. Render the parts through, jam taut, lay up and whip the end, Fig. 27. This knot is used for bucket ropes, &c. It should have a leather washer around its neck when exposed to chafe.

A Single Diamond Knot, Fig. 29, Plate 5. Unlay the end of a plain-laid rope for a considerable length, Fig. 28, and with the strands form three bights down its side, holding them fast. Put the end of strand (1) over strand (2), and through the bight of strand (3), as in the figure; then put the strand (2) over strand (3), and through the bight formed by the strand (1), and the end of (3) over (1), and through the bight of (2). Haul these taut, lay the rope up again, and the knot will appear like Fig. 29. This knot is used for the side ropes, jib guys, bell ropes, &c.

A Double Diamond Knot, for the same purpose, Fig. 30, Plate 5. With the strands opened out again, follow the lead of the single knot through *two single* bights, the ends coming out at the top of the knot, and lead the last strand through *two double* bights. Lay the rope up again as before, to where the next knot is to be made, and it will appear like Fig. 30.

A Sprit-Sail Sheet Knot, Fig. 33, Plate 5. Unlay two ends of a rope, and place the two parts which are unlaid, together, Fig. 31. Make a bight with the strand (1). Wall the *six* strands together, *against* the lay of the rope (which being *plain-laid* must be done from the right hand to the left), exactly in the same manner that the single walling was made with three; putting the second over the first, the *third* over the second, the fourth over the third, the fifth over the fourth, the sixth over the fifth, and through the bight which was made by the first: haul them rather taut, and the single walling will appear like Fig. 32; then haul taut. It must be then crowned, Fig. 33, by taking the two strands which lie most conveniently (5 and 2) across the top of the walling, passing the other strands (1, 3, 4, 6) alternately over, and under those two, hauling them taut; the crown will be exactly similar to the figure. It may be then double walled, by passing the strands (2, 1, 6, &c.) under the wallings on the left of them and through the same bights, when the ends will come up for the second crowning, which is done by following the lead of the single crown, and pushing the ends down through the walling, as before, with three strands. This knot, when double-walled, and crowned, is often used as a stopper knot, in the Merchant Service.

HITCHES.

A Stopper Knot, Fig. 34, Plate 6. This is made by a single walling and *double walling* (as described page 8), *without crowning*, a three-stranded rope, against the lay, and stopping the ends together, as in the figure. The ends, if very short, are whipped without being stopped. This knot is used for Deck Stoppers, having a laniard spliced around the neck of the knot, and a hook and thimble spliced in the other end.

A Shroud Knot, Fig. 37, Plate 6. Unlay the ends of two ropes, Fig. 36, placing them one within the other, drawing them close as for splicing; then single-wall each set of ends—those of one rope, against the lay, (i. e. from left to right if the rope be cable-laid, as in the figure), round the standing part of the other. The ends are then opened out, tapered, marled down, and served with spun-yarn. This knot is used when a shroud is either shot or carried away.

A French Shroud Knot, Fig. 35, Plate 6. Place the ends of two ropes as before, Fig. 36, drawing them close. Lay the ends (1, 2, 3) back upon their own part (b), single-wall the ends (4, 5, 6), round the bights of the other three, and the standing part (b), and it will appear like Fig. 35. The ends are tapered, &c., as before. This knot is much snugger, and equally secure as the other.

A Grecian Shroud Knot or Splice, Fig 38, Plate 6. Say that the rope to be spliced is a 7½ inch topmast backstay. Put a whipping on, unlay the ends, lay the four strands up into ten yarn foxes, short splice the hearts together, and serve them hard over with yarn. Then marry the foxes, and pass the ends that lie upwards over the next downward one on the right and under the bight of the second downward one, working round to the right. Haul all parts taut, scrape the ends down, marl over hard, parcel well with tarred canvas and serve. This splice is particularly neat; and as there are no bends in it, it is necessarily much stronger than a common shroud knot.

A Buoy-Rope Knot, Fig. 40, Plate 6. Unlay the strands of a cable-laid rope, and also one of the *small* strands out of each large one, laying up the large ones again as before, and leaving the small ones out, like Fig. 39—then *single* and *double* wall the small strands (as directed for the stopper knot) round the rope, Fig. 40, worm them along the lay, and stop their ends with spun-yarn (d).

HITCHES.

Hitching a Rope, Fig. 41, Plate 6, is performed thus: Pass the end of a rope (b) round the standing part; bring it up through the bight, and seize it to the standing part at (d). This is called

PLATE 6

Fig. 34

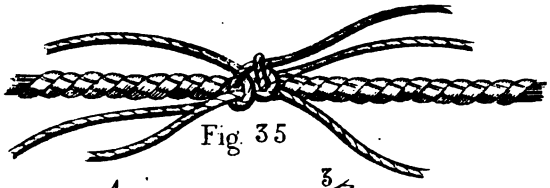


Fig. 35

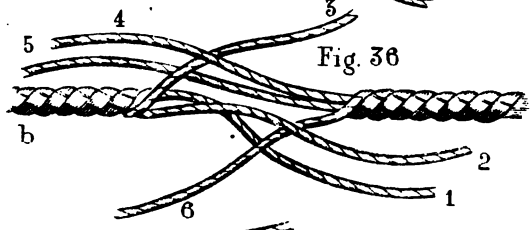


Fig. 36

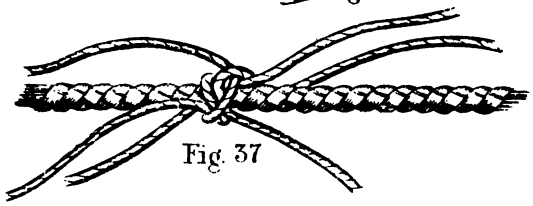


Fig. 37

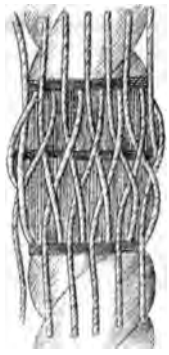


Fig. 38

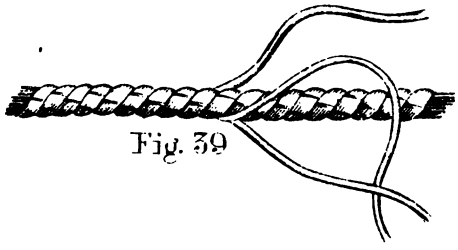


Fig. 39

Fig. 40 d

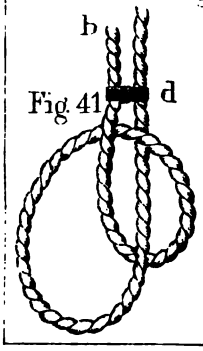


Fig. 41

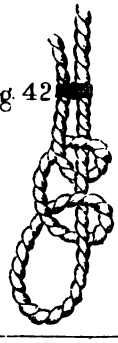


Fig. 42

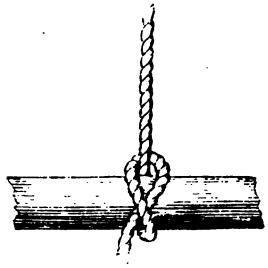


Fig. 43

PLATE 7

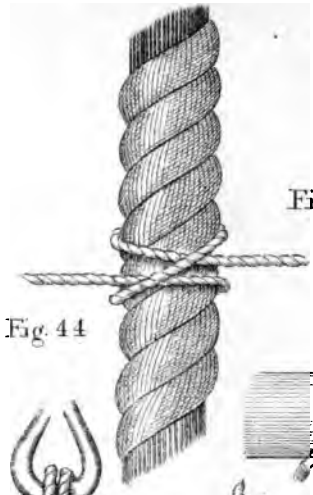


Fig. 44

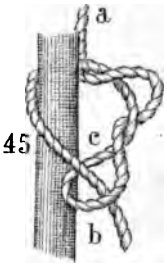


Fig. 45

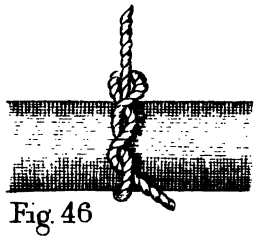


Fig. 46

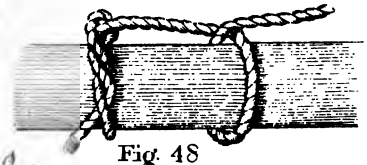


Fig. 48

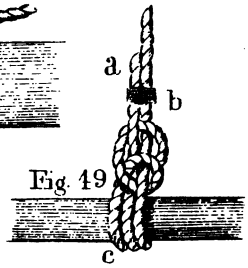


Fig. 49

Fig. 47

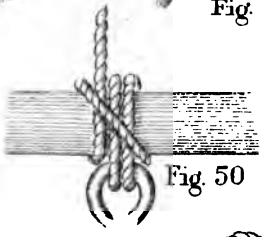
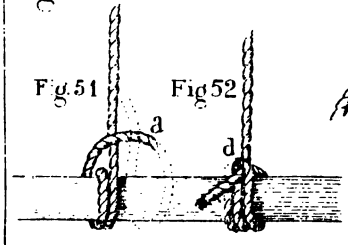


Fig. 50



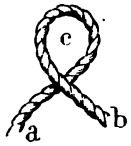
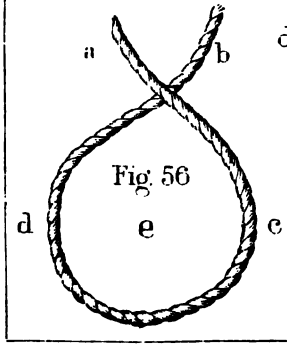


Fig. 53

Fig. 54

Fig. 55



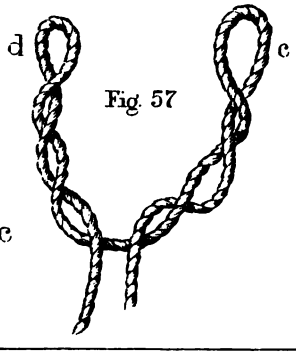
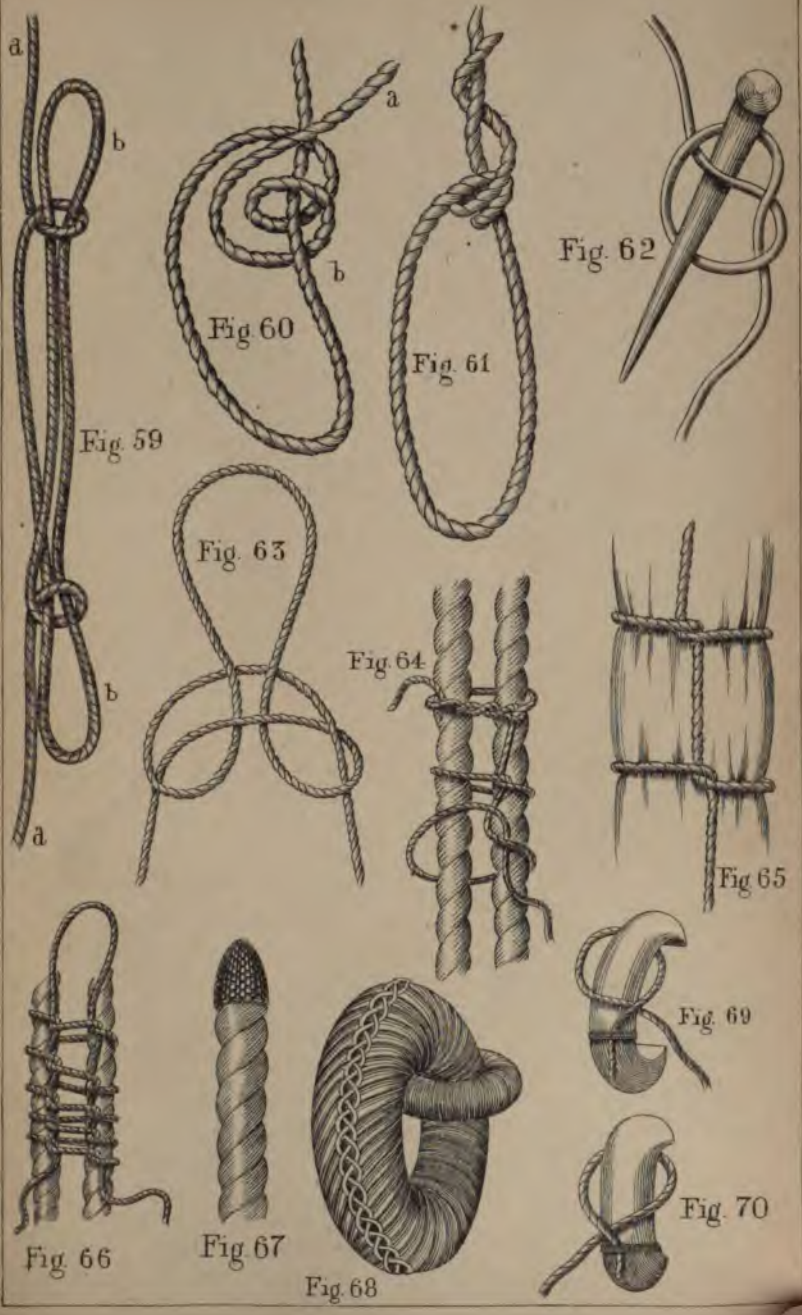


Fig. 58

PLATE 8


a
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b
a
Fig. 59
a
b
Fig 60
Fig. 61
Fig. 62
Fig. 63
Fig. 64
Fig. 65
Fig. 66
Fig. 67
Fig. 68
Fig. 69
Fig. 70

a *Half-hitch*. Two of these, one above the other, Fig. 42, are called *Two Half-hitches* or a *Clove-hitch*. Fig. 43 represents a half-hitch around a spar; Fig. 44, Plate 7, a clove-hitch, with a ratline around a shroud.

A Timber-Hitch, Fig. 46, Plate 7. Take the end part of a rope (a) round a spar or timber-head, lead it *under* and *over* the standing part (b), pass several turns round its own part (c), and it is done.

A Round Turn and a Half-Hitch, Fig. 47, Plate 7. Used for bending a hawser to the ring of an anchor.

A Timber and Half-Hitch, Fig. 48, Plate 7. Used for bending a line to a spar, for towing, &c.

A Rolling Hitch, Fig. 49, Plate 7. With the end of a rope (a) take two round turns over a spar, &c., at (c), pass two half-hitches round the standing part (b), and it is finished. The end may be stopped to the standing part.

A Roband Hitch, Fig. 50, Plate 7. For bending the roband of a sail to the jackstay.

A Magnus Hitch, Fig. 52, Plate 7. Pass two round turns with the end of a rope (a) over a spar, Fig. 51; then, bringing it before the standing part, pass it again under the spar, and up through the bight which it made, Fig. 52, the end part being jammed by the bight (d).

A Blackwall Hitch, Fig. 54, Plate 7. Form a bight (c), Fig. 53, by putting the end (a) across under the standing part (b). Put this bight over the hook of a tackle, Fig. 54, letting the part (b) rest upon it, and the part (a) be jammed by the standing part at the cross. This is sometimes used with a laniard, when setting up the shrouds.

A Double Blackwall Hitch, Fig. 55, Plate 7.

A Cat's Paw, for the same purpose, Fig. 58, Plate 7. Lay the end of a rope (a), Fig. 56, over the standing part (b), forming the bight (e), take the side of the bight (c) in the right hand, and the side (d) in the left, turn them over from you three times, and there will be a bight in each hand (c d), Fig. 57. Through these put the hook of a tackle, Fig. 58.

A Sheep Shank, Fig. 59, Plate 8. This is made for shortening a back-stay, &c.—a half-hitch is taken with the standing parts (a) round the bights (b), when it will appear like the figure.

A Midshipman's Hitch, Fig. 61, Plate 8. With the end of a rope (a), Fig. 60, take a half-hitch round the standing part (b), take another turn through the same bight, jamming it between

the parts of the hitch ; when hauled taut, it will appear like Fig. 61. The end may be taken round the standing part, or stopped to it. It is thus a tail-jigger is clapped on a rope, or fall, to augment the purchase. This is a good hitch for a stopper, as it will not slip, and is in very general use, though not commonly known by the above name.

A Marling-Spike Hitch, Fig. 62, Plate 8. Always used in heaving on seizings. The spike is used as a pry, to heave the seizing taut.

A Harness Hitch, Fig. 63, Plate 8.

A Marling Hitch, Fig. 64, Plate 8, is used in marling down the yarns left out from a splice ; for the marling put over parcelling ; and for making selvagee straps, &c. It is the same as used for lashing up hammocks, Fig. 65, where seven such turns are allowed.

A Marling Hitch, for various purposes, is formed by middling the marline, laying the bight on the top in the centre and securing it there ; then dip the right hand end underneath and take a turn under and round the left, bring the left up and take a hitch over and through the bight of the right hand end, heave the turns taut, and keep them square. Fig. 66, Plate 8.

Hitching the End of a Rope. Trim the end off with a knife to the shape of a cone : then, with a sail-needle and twine, stitch it around with a loop-stitch, first taking a few round turns with the twine. When finished it will resemble Fig. 67, Plate 8. All running rigging have the ends hitched to prevent unlaying, as in the figure, instead of the ordinary whipping. All the gun-tackle falls should have their ends hitched, as it is neater and better than the ordinary whipping.

To Hitch over a Ring-Bolt, Fig. 68, Plate 8. A ring-bolt is usually hitched over with either two or three ends. With two ends,—after seizing or hitching the ends you are not working on to the ring-bolt, you commence by taking a left-handed hitch with one of the tails, keeping the cross on the centre of the bolt, which brings the end out to the right ; you then double this end back over its own part to the left, bring up the other tail over this, take a hitch as with the first, double it back, bring up the first end, and so go on, taking alternate hitches with each, and bringing the end out to the right with each hitch.

With three ends, you begin by taking a left-handed hitch with the first leg, a right-handed hitch with the second, then a left-handed with third, right-handed with first,—left, second,—right, third,—and so on, each hitch being passed in the opposite way to the preceding one—two ends and one end alternately lying

PLATE 9

Fig. 71

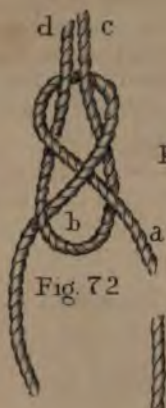

Fig. 72

Fig 73

Fig. 74

Fig 75

Fig. 76

Fig. 78

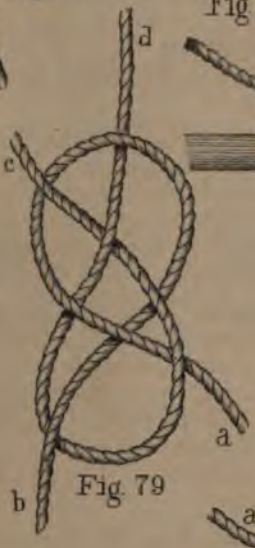

Fig. 79

Fig. 77

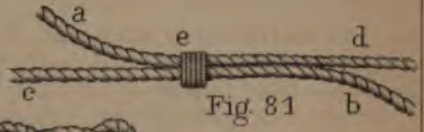

Fig. 81

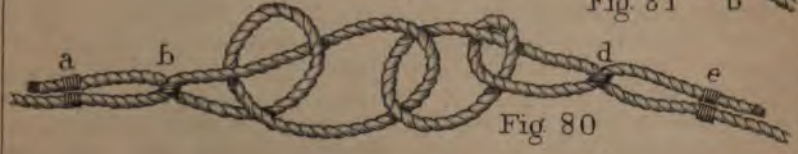

Fig. 80

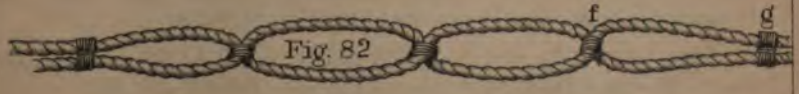

Fig. 82

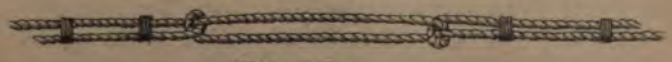

Fig. 83

BENDS.

on each side. The ends are finished off by scraping them down and either passing a whipping or working a Turk's head round them. When finished, it has the appearance shown in Fig. 68.

Kackling, Fig. 71, Plate 9. To prevent chafe, secure one end and hitch right and left handed, alternately.

BENDS.

A Sheet Bend or Single Bend, Fig. 72, Plate 9. Pass the end of a rope (a) through the bight of another rope (b), then round both parts of the rope (c d), and down through its own bight. It is sometimes called also a *Becket-bend.*

A Double Bend, Fig. 74, Plate 9, is simply taking the end around a second time. The single bend is the most common one in use. The standing part of most purchase falls are thus secured to the becket in the strap of the purchase block, as in Fig. 73.

A Fisherman's Bend, Fig. 75, Plate 9. With the end part of a rope take two turns (c) round a spar; a half-hitch round the standing part (b), and under the turns (c); then another half-hitch round the standing part (b). This is sometimes used for bending the studding-sail halliards to the yard, but more frequently for bending a hawser to the ring of an anchor, in which case the end should be stopped down with spun-yarn, Fig. 76.

The Studding Sail Halliard Bend, Fig. 77, Plate 9, is preferred to all others for bending halliards to yards, as it is safe and snug.

A Carrick Bend, Fig. 79, Plate 9. Form a bight (c), Fig. 78, by laying the end of a rope (a) across the upper surface of its standing part (b). Lay the end (e) of another rope (d) under (a and b); then following the lead of the dotted line, pass it *over* (a), *through* the bight, *under* (d), and up through the bight again, Fig. 79; (c) there representing the end (e) in the other figure. This bend is much used for hawsers.

Hawsers are sometimes bent together thus, Fig. 80, Plate 9; the hawser has a half-hitch cast on it, a throat seizing clapped on the standing part (b) and a *round* one at (a). Another hawser is rove through the bight of this, hitched in the same manner, and seized to the standing part (d, e).

And frequently the ends of two ropes (a c), Fig. 81, Plate 9, are laid together; a *throat* seizing is clapped on at (e), the end (a) is turned back upon the standing part (b), and the standing part (d) brought back to (c); another throat seizing is put on

CLINCHES—SPLICING.

each, as at (f), Fig. 82, and a round seizing near the end at (g); the same security is placed on the other side.

A Reeving Line Bend, Fig. 83, Plate 9, may also be used for small hawsers.

In any case of bending hawsers, towlines, &c., the end should be securely stopped down with spun-yarn, using racking turns if much strain is anticipated.

The best bend for a hawser to a kedge is a Fisherman's Bend, Fig. 89, Plate 10, or a round turn and a couple of half-hitches, Fig. 88, with the end stopped down with spun-yarn.

CLINCHES.

The clinch is made like Fig. 84, Plate 10; the end of a bridle or leech line, for example, is rove through the cringle (f), taken round the standing part (e), forming a circle; two round seizings (d) are then clapped on. *The clinch on any rope is always made less than the cringle, &c., through which the rope is rove.*

There is an *outside* clinch, Fig. 85, Plate 10; and an *inside* clinch, Fig. 86.

To Bend a Hemp Cable, use an *inside clinch.* The end of the cable (a), Fig. 87, Plate 10, is taken over and under the bight (b), forming the shape of the clinch, which must not be larger than the ring of the anchor (d). The seizings (c), which are called the BENDS, are then clapped on and crossed.

SPLICING.

Ropes are joined together, for different purposes, by uniting their strands in particular forms, which is termed *Splicing.* A splice is made by opening, and separating the strands of a rope's end, and thrusting them through the others which are not unlaid. The instruments used for this are Fids, Marling-Spikes, and Prickers. Ropes reeving through blocks are joined by a long splice, otherwise a short splice is used. *The splice is weaker than the main part of the rope by about one eighth.*

A Fid is made according to the size of the rope it is meant to open and is tapered gradually from one end to the other, Fig. 90, Plate 10. It is commonly made of hard wood, such as Brazil, Lignum Vitæ, &c., and sometimes of iron; when of the latter, it has an eye in the upper end, like Fig. 91.

A Marling-Spike is an iron pin of similar mould, on the upper end of which is raised a knob, called the Head, Fig. 92, Plate

PLATE 10

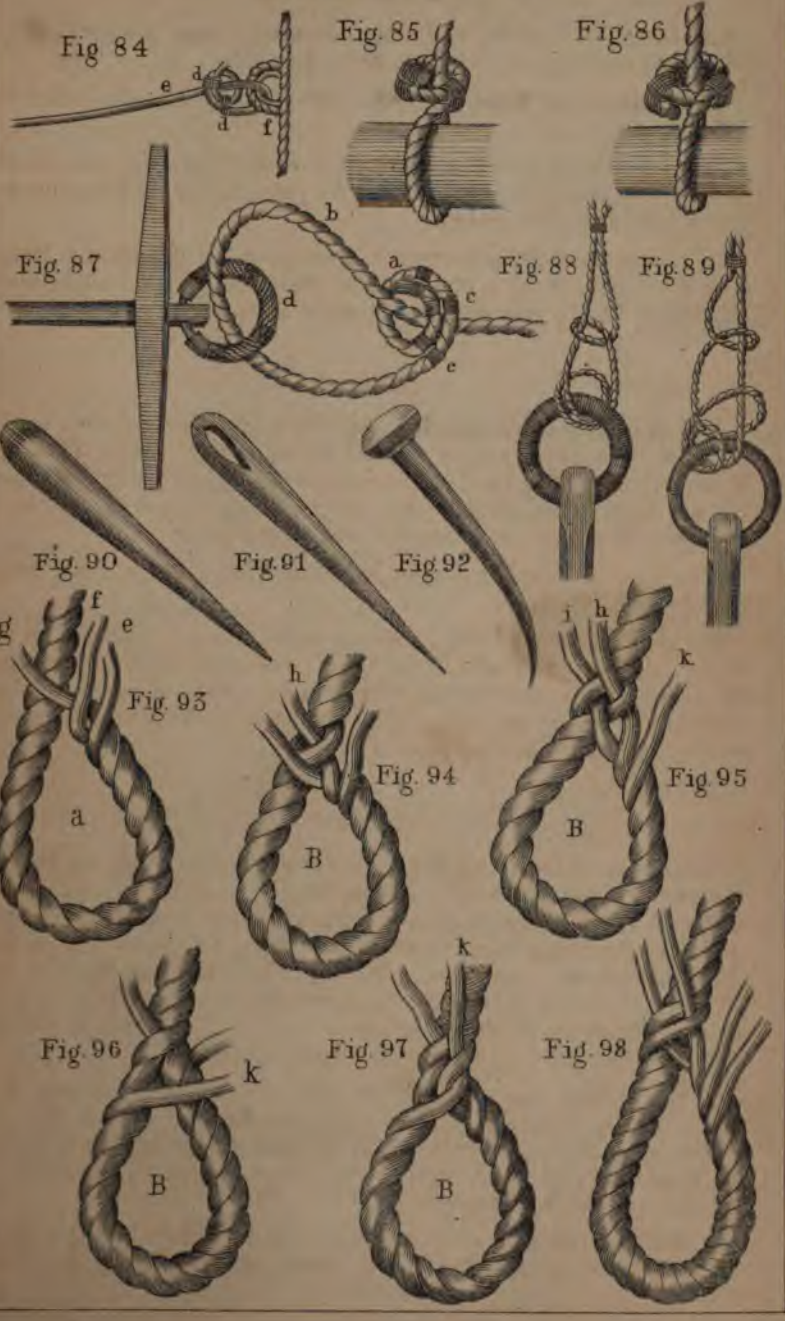
Fig 84
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Fig. 86
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Fig. 91
Fig. 92
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Fig. 98

PLATE 11

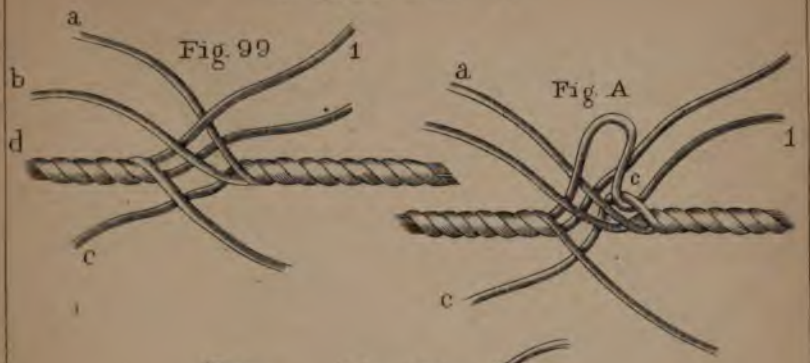


Fig. 99

Fig. A

Fig. 100

Fig. 101

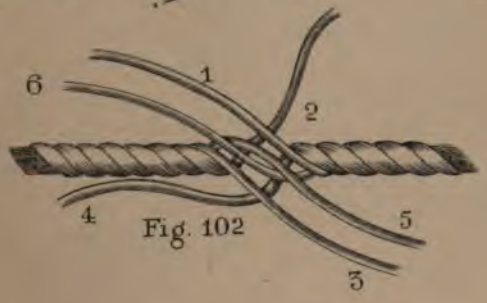


Fig. 102

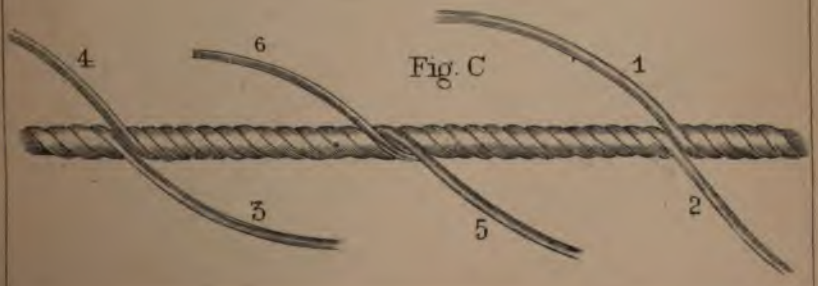


Fig. C

10: or it may be similar to Fig. 91. It should always have a good laniard attached, and when used aloft, either slung around a man's neck, or to the rigging.

A Pricker is made of metal, hard wood, or bone, and is used for light work.

An Eye-Splice, Fig. 93, Plate 10, is made by opening the end of a rope, and laying the strands (e, f, g) at any distance upon the standing part forming the Collar or Eye (a). The end (h), Fig. B, is pushed through the strand next to it (having previously opened it with a marling-spike); the end (i) is taken *over* the same strand, and through the second; and the end (k) through the third, on the other side. After sticking the ends once, one-half of the yarns may be cut away from the under part of the strands, and the remainder stuck again, in order to taper the splice and make it neater. In a four-stranded rope, the left hand end lies under two strands, Fig. 98.

An Eye-Splice in a Wire Rope. Wire requires more end for splicing than hemp. Stick the whole strand once, once two thirds, and once one third of a strand, which will make a good taper; then set it up and stretch it well, break off the yarns close to the rope by working them backwards and forwards quickly, two or three times; then parcel and serve over with spun yarn. After sticking the ends once, clap on a good stop around all to keep the parts close together while sticking the second time, and so on. Each wire must be stuck separately.

A Short Splice. To splice the two ends of a rope together, proceed thus: Unlay the strands for a convenient length; then take an end in each hand, place them one within the other, Fig. 99, Plate 11, and draw them close. Hold the strand (a, b, c) and the end of the rope (d) fast in the left hand, or if the rope be large, stop them down with a rope-yarn; then take the middle end (1), pass it over the strand (a), and having opened it with the thumb, or a marling-spike, Fig. A, push it through under the strand (c), and haul it taut. Perform the same operation with the other ends, by leading them *over* the first and next to them, and *through* under the second, on both sides; the splice will then appear like Fig. 100; but in order to render it more secure, the work must be repeated; leading the ends *over* the third and through the fourth; or the ends may be untwisted, scraped down with a knife, tapered, marled, and served over with spun-yarn.

When there is to be no service used, the ends should be stuck twice each way, otherwise once and a half is sufficient. In anchor straps, and heavy straps generally, the ends *are stuck twice and not trimmed off but whipped.*

SPLICING.

A Short Splice with a Four-Stranded Rope, Fig. 101, Plate 11.

The Long Splice, Fig. 102, Plate 11. To make this splice, unlay the ends of two ropes to a convenient distance, and place them one within the other, as for the short splice; unlay one strand for a considerable length, and fill up the intervals which *it* leaves with the opposite strand next to it. For example, the strand (1) being unlaid for a particular length, is followed in the space which it leaves by the strand (2). The strand (3) being untwisted to the left hand, is followed by the strand (4) in the same manner. The two middle strands, (5 and 6), Fig. C, are split; an over-hand knot is cast on the two opposite halves, and the ends led over the next strand and through the second, as the whole strands were in the short splice; the other two halves are cut off. Sometimes the *whole* strands are hitched, then split, and the *half* strands put through in the same manner; but the surface is not so smooth, and the former method seems sufficient. When the strand (2) is laid up to the strand (1), they are divided, knotted, and the ends cut off in the same manner; and so with 3 and 4. This splice is used for lengthening a rope which reeves through a block, or sheave-hole, the shape of it being scarcely altered. After splicing, *the ends should not be trimmed off until after the splice has been subjected to a good strain.*

The following is somewhat neater. Fig. 103, Plate 12. Unlay the ends alike, and marry them together; unlay a strand on each side, and lay the strand of the other end, that is opposite to it, up in the lay that it comes out of, making both equidistant from the centre pair of strands, which you do not touch. Twist each pair up as you have done with them, to keep them in their places, and grease the strands. For a large rope, such as the fore brace, instead of knotting the strands, merely lay them alongside each other in the score of the rope, then put the ends in once, a half, and a quarter, and *back it* with the remaining quarter of a strand to taper it off. In splicing, instead of laying a strand over one, and under the next, you *back it* by putting the strand in left-handed, under the strand you would otherwise have laid it over, Fig. 104; which gives it an exceedingly neat and serviceable finish.

The same with four strands, Fig. 105, Plate 12.

A Cut or Bight Splice, Fig. 106, Plate 12. Cut a rope in two, and, according to the size of the collar or eye you mean to form, lay the end of one rope upon the standing part of the other, and push the ends through, between the strands, in the same manner as for the eye-splice, shown in Fig. 93, Plate 10. This forms a collar or eye (u) in the bight of the rope. It is used for pendants, jib guys, royal shrouds, &c. The yarns left out from

PLATE 12

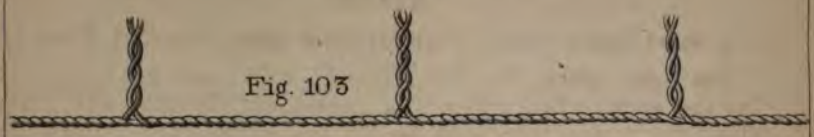


Fig. 103

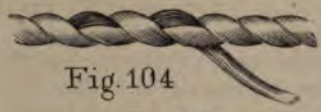
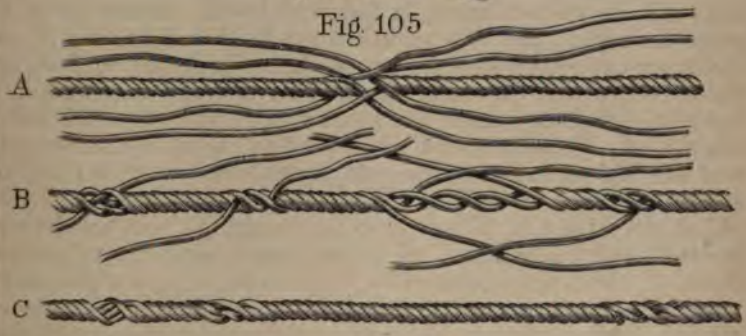


Fig. 104

Fig. 105



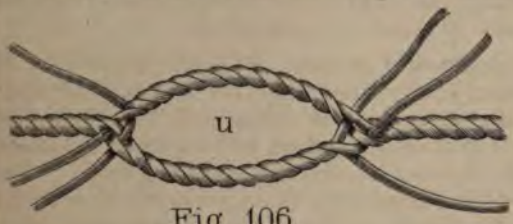


Fig. 106

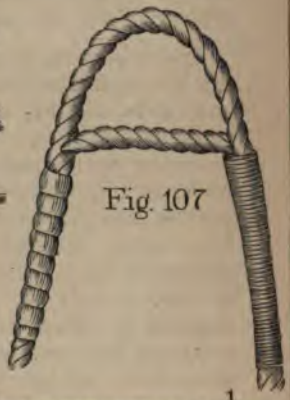
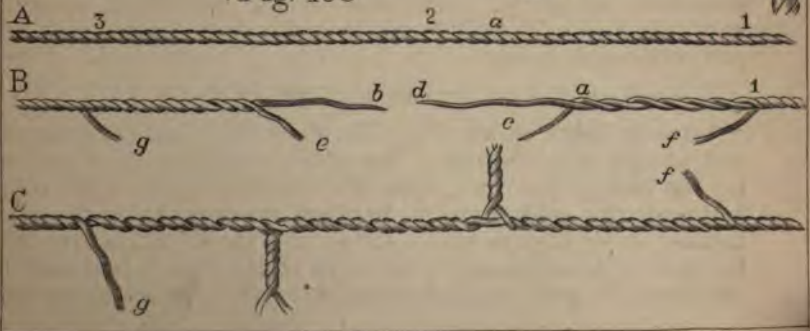


Fig. 107

Fig. 108



the strands should be scraped, marled down and served over, when neatness is required.

A Horse-Shoe Splice is made similar to a cut splice, but differs in shape. Odd topmast backstays, top-gallant and royal backstays may be fitted in this way, in which case the splice is served over, as in Fig. 107, Plate 12.

To Long-Splice a Three and a Four stranded Rope Together. Unlay the ends of the two ropes to a sufficient length and crotch them; unlay one strand of the three-stranded, and fill the space with a strand of the four-stranded rope; then unlay a strand of the four and fill up from the three-stranded rope; there remains two strands of the four, and one of the three; divide the single strand by taking out one third, with which knot to one of the remaining pair, then unlay the other one, and fill up with the remaining two thirds; knot and stick once, stretch well, and trim off.

Another way is to work three strands as usual, and stick the fourth strand where it lies. The first plan is the better.

To Short-Splice a Three and a Four Stranded Rope. Unlay the ends, and divide one of the three strands in half, making four strands, and proceed to splice.

Lengthening a Rope with an Additional Strand, Fig. 108, Plate 12. Cut a strand at 1, unlay until you come to 2, and cut another strand; unlay both to 3 (equal to the distance from 1 to 2, or thereabouts), and there cut the last strand; separate the parts, and they will appear as in Fig. 108, B. Measure off the increased length required from 1, mark it (a), and bring the end of the left-hand piece (b) down to (a), and lay it in. The second strand, at 2, must have been cut sufficiently far from (a) to allow end enough for knotting and laying in. Twist the ends (c and b) up together ready for knotting, on finishing the splice, and (d and e) in the same manner for the present; the splice will then have the appearance represented in Fig. 108, C. Cut a piece of rope, and unlay a strand sufficiently long to fill in the vacant lay between (f and g), and to knot with the ends (f, g); lay the strand in, and finish off as with an ordinary long-splice, from which it will only differ in appearance by its having four breaks in the rope instead of three. In putting in the long strand, care must be taken to follow the lay along correctly, or it will not tally with the ends (f, g), with which it knots.

If it is required to give a sail more spread by inserting a cloth, the head and foot rope must be lengthened in this way. For all sizes of rope, take eight times the round for splicing, in addition to what is wanted to lengthen the rope. To lengthen

two feet, cut the strands three feet apart; and the additional strand must be over nine feet long.

To Shorten a Rope in the Centre. Proceed precisely as in the previous case; but, instead of separating strand (b) from 1, bringing it down to (a), *take it up* on 1 as far as you require to reduce the rope. No additional strand is used, so knot (b, f), (d, g), and (e, c); finish off the ends, and in appearance it differs in no way from the common long-splice.

In the same way, if a strand of a rope has been chafed, Fig. 109, Plate 13, it may be cut out, and a fresh strand laid in its place, sticking the ends as in a splice.

To Splice a Rope Around a Thimble. Whip the rope at twice and a half its circumference from the end. The length to go round the thimble should be once the round of the thimble, and once the round of the rope, from the whipping to where the first strand is to be stuck. If the splice is not to be served, whip the ends of the strands, to prevent them from opening out into yarns, and stick them twice, whole strand. If to be served, after one half of each strand is put through, it is cut off, and the other half is opened out, wormed along the lay, and marled down. Parcel the thimble.

A Sailmakers' Splice is used when ropes of different sizes are to be joined neatly, and they require tapering, that the change may be gradual; as in splicing the leech and head rope of a top-sail.

Unlay enough of the small rope to stick the ends once and a half, but of the larger one, unlay for a considerable distance, according to the relative disproportion of the ropes, and the degree of tapering required; crotch, as for a common splice. Take a strand of the large rope, cut away about one fourth from the under part, and put it, left-handed, through the corresponding strands of the small rope; cut away a few more yarns, and pass it again, back-handed, *round the same strand* of the small rope; and so proceed, working with the same strand of the large rope round and round the same strand of the small one, cutting away gradually till it is reduced to nothing. Then, one at a time, put the other large strands through in a similar manner, cutting away more or less of the third strand, as may be necessary to give roundness to the splice. Finally, slue round and splice the small strands into the large rope, as in a common short splice, tapering the ends.

A Mariner's Splice is a long splice in a cable-laid rope. Proceed as in a long splice, when, instead of sticking the strands, they in turn are long spliced; get it on a stretch with luffs, and

PLATE 13

Fig. 109

Fig. 110

Fig. 111

Fig. 112

Fig. 113

trim off the ends. This splice is not very often used, for it can be done only with old soft hawsers, which should rather be shroud-knotted, the ends marled down and served over.

Splicing a Hawser. Work a long splice, as with a plain-laid rope, but, instead of knotting the strands, unlay them, marry them together, and tuck them in under the strand that you would reeve them through if you had knotted them in the usual manner; under this first strand of the hawser put all three strands of the strand; under the next, two only; then one, and, lastly, *back* this one.

Splicing Rope Cables. Cut off the ropemaker's fag-end, and unlay the cable sufficiently far for splicing. Take the inside yarns and lay them up into three strands, equal to the piece of rope intended for the tails, and splice these small strands and tails together. Take the outside yarns and make them into three-yarn plaits or knittles, then marl the remaining yarns down over the splice and tail, and point over all with the plaits or knittles.

The cable is then opened with setting fids and commanders, and the splice made, each strand boused through with jiggers; the ends are put in twice on the tier, and once on the anchor part. Take a good piece of small rope, and pass it as a round-seizing, close to the splice, and cross it on all sides. When finished it will look square; and pass another, with smaller stuff, close to the ends. Worm the ends into the lay of the cable, and pass three or four spun-yarn seizings, at equal distances, round them and the cable, to keep them in the lay; *snake* the seizings, and whip the ends of the tails. The size of the seizing, and number of turns, depend on the size of the cable.

A Ropemaker's Eye, Fig. 110, Plate 13, is formed when making the cable, two of the strands being a long rope twisted up on the bight, and thus forming an eye at one end; an eye is also formed in the end of the third strand, each of its smaller strands being wormed round the cable without being spliced.

To Splice a Small Rope to a Chain, Fig. 111, Plate 13. Unlay the end and reeve *two* of the strands through the end link; unlay the third strand (3) some distance back, following it up as in a long splice with one of the other strands (2); half knot and stick as in a splice; the remaining end (1), one of the two rove through the link, is stuck where it is, near the link, as in an eye splice. This is a very neat and strong splice, and is used for tailing rope to chain topsail sheets; for the standing part of a fall where neatness is required, &c.

A Ropemaker's Eye is also used for forming the collars of stays. A four-stranded stay, Fig. 112, Plate 13, is unlaid, two strands

each way; then each half is doubled back, and laid up with its own part. At the fork, four strands are worked in as in splicing, tapering off by thinning the strands each time they are stuck. The eyes and fork are then wormed and served over, Fig. 113. If, instead of laying back *both* strands to the crotch, but one is so treated, while the other is opened out and used for worming, then each lay will be three-stranded, and look much neater. Such is the practice in our service.

When the jib-stay is fitted to go with a lashing eye, the eye may be formed in a manner somewhat similar. With a four-stranded rope, unlay about eight times its own circumference. Marl two strands together; tar and parcel sufficient length, and form the eye. Unlay the other two strands, one at a time, and fill up the vacant lays by the strands forming the eye; one strand unlay about two feet, the other about one foot, from the eye; stick as in a long splice; stretch, worm, and serve over.

If the jib-stay or rope is *three-stranded*, the eye may be formed in the same way. Unlay the rope, say seven times its own circumference, marl *two* strands together, tar, parcel and form the eye, putting in a thimble or not, as required; unlay the third strand, following it up by one of the strands that formed the eye, to a distance of about eighteen inches; cross the ends and stick, as in a long splice. The other strand that formed the eye is divided into three equal parts, a portion of each is put in the lays of the rope for worming, and the remainder is tapered, marled down and served over with spun-yarn. This, too, may be termed a ropemaker's eye. It is strong enough to break the rope.

A Flemish Eye, Fig. 115, Plate 14. Take the end of a rope, and unlay one strand (7), Fig. 114, to a certain distance; and form the eye, Fig. 115, by placing the two strands (8) along the standing part of the rope, filling up the intervals (marked by the shade) with strand (7), till it returns and lies under the eye with the strands (8). The ends are scraped down, tapered, marled, and served over with spun-yarn.

An Artificial or Spindle Eye, Fig. 116, Plate 14, sometimes, though improperly, called a Flemish eye. Put a whipping on the rope at three and a half times its circumference from the end, which unlay. Take a piece of round wood twice the size of your rope, and lash it to a convenient place, having yarn stops on it to stop the eye after it is formed. With a four-stranded rope, unlay the heart and divide it in two; bring the rope under the spar with two strands, and half the heart on each side; pass the heart over and half knot it on top, heaving the rope close up to the spar with a bolt on each side. The width of the eye should be one third the round of the rope; take from each strand two

PLATE 14

Fig. 114

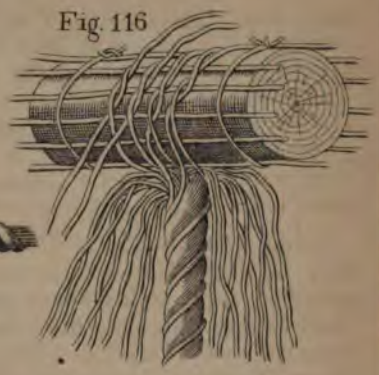


Fig. 116

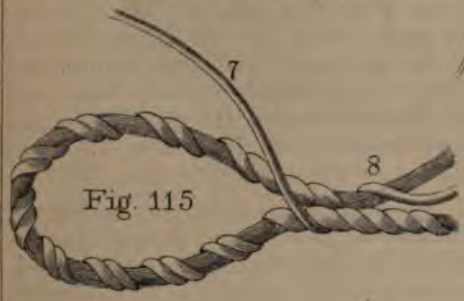


Fig. 115

Fig. 117

Fig. 118

Fig. 119

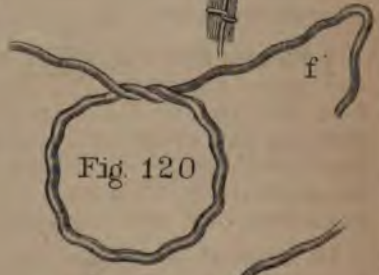


Fig. 120

Fig. 121

yarns for every inch of circumference of rope; if a 10-inch rope take twenty yarns, twist them up, and half-knot them on top of the spar, heave taut and pass them down the lay of the rope for wormings; put a spun-yarn seizing on close to the eye, and another about nine inches below, and put a yarn stop around the ends to keep them in the lay of the rope. Take two thirds as many yarns from each strand, as were used for worming, haul them taut, half-knot them on top, hauling them well taut, and so continue until the yarns are all expended. The yarns must be set well taut alike, or they will not bear an equal strain. Smooth the yarns down and put a stop round all, close underneath the toggle. Half-knot the stops laid lengthwise on the spar, heave them taut with a marling-spike on each side of the eye; form the other half-knot and heave it taut. Marl the eye with two or three yarn spun-yarn; the hitches to be about an inch apart, commencing at the centre of the eye and working both ways; cut the stops as you come to them. Pass a strand round all, close to the spar underneath, and heave taut with marling-spikes, to work the worming taut along the lay; then put on a good spun-yarn seizing. Now tar and parcel the eye and serve it with spun-yarn, fid out, and it is finished, Fig. 117.

This makes a neat eye for the end of a stay. It is frequently used, too, for the lower end of man-ropes where the laniard is spliced in.

When hemp cables were in general use and splicing necessary, they used a TAPERED SPLICE, Fig. 118, Plate 14, where the strands were thinned out gradually and the splice served over with spun-yarn a little beyond the entire length; looking, when finished, something like a *mousing*.

Also, the **Drawing Splice,** Fig. 119, Plate 14, used that the splice might be drawn and the lengths of cable separated. After making a short splice, the ends, which are left long, are tapered off and neatly pointed; these are wormed into the lay, after splicing, and good seizings clapped on at intervals.

A Grommet, Fig. 121, Plate 14, is made by unlaying a strand of a rope, Fig. 120, placing one part over the other, and with the long end (f) following the lay till it forms the ring, Fig. 121, casting an over-hand knot on the two ends, and, if necessary, splitting and pushing them between the strands, as in the long splice. The test of a well-made grommet is, to throw it on the deck when it should lie perfectly flat. Worn or four-stranded rope makes the best. For grommet straps for yard or block, take three times the round of yard or block and three times the round of the thimble, allowing six times the round of the rope

SPLICING.

for splicing. The length to marry the strands is, once the round of the block and thimble.

Working a Cringle in a Rope. Unlay a single strand from a rope of the size that the cringle is required to be; begin on the left, and put this strand under two strands of the rope you are working it on; divide it into thirds and haul two thirds of it through, so that the long leg is from you; lay the two parts up together so as to form sufficient for the round of the cringle, but always with an odd number of turns, ending with the long leg towards you, Fig. 122, Plate 15; stick it from you under two strands; bring it round and work back to the left; put it under two strands towards you, leaving one strand intervening between the place you entered it, then back over one, and down under two, Fig. 123. Now tuck the short end in under the same two strands in the rope that the cringle is already worked through, then over one, and under two; cut the ends off, and serve the cringle over.

If a cringle is to be worked into the leech of a sail, the strand is taken round the rope and through the eyelet-hole in the sail, Fig. 124, Plate 15; and the ends are finished off by taking a hitch round all, and then passed under two, over one, and under two, as before.

Grommet Muzzle-Lashing for Housing Guns. A grommet made of rope double the size of the gun-tackle falls, with two cringles worked into it for the frapping lashing, which will be of stuff half the size of the tackle-falls.

The grommet should be made large enough just to slip over the swell of the muzzle when the bight is over the housing hook-bolt, and the gun is in position for housing. It should be wormed throughout, and parcelled in the wake of the housing bolt and frapping-lashing, and when there is no swell, in the wake of the muzzle ring.

When the housing-bolt is an eye-bolt, the grommet is secured to it by means of a toggle which has a laniard.

Breechings for all guns are to be made of the best hemp, of three-stranded rope, shroud-laid* and soft, and not to measure less than seven and a half, nor more than eight inches in the coil, excepting those for 9-inch guns, which are to measure nine inches.

In fitting breechings, a thimble is to be *spliced* into one end, the strands stuck through twice and marled down. A thimble

* *Shroud-laid:* laid up of the same kind of yarns as used for shrouds, and in the same way.

PLATE 15

Fig. 122

Fig. 123

Fig. 124

Fig. 125*b*

Fig. 125*a*

Fig. 126

Fig. 127

Fig. 128

SEIZINGS, ETC.

is to be *turned into* the other end, so that the length of the breeching may be conveniently altered. Thus fitted, when the gun is run in and levelled, breechings must be long enough to allow the muzzle of the gun to come a foot inside of the upper port sill, if the breadth of the vessel will allow it. With guns of violent recoil, this distance may be advantageously doubled, where there is room enough, as thereby the strain will be much lessened.

Breechings are neither to be covered, nor blacked, nor rendered less pliable.

SEIZINGS, POINTING, GRAFTING, MOUSING, ETC.

Seizing a rope, is binding the two parts together with spun-yarn, house-line, marline, or small stuff.

Round Seizings have two cross turns.

Flat Seizings have no riding turns.

All seizing stuff should be well stretched before use, and, excepting throat-seizings, are generally hove on over parcelling.

A Spanish Windlass, Fig. 125 (a), Plate 15, is used for heaving two parts of a shroud, or any rope requiring it, together at the nip, before passing the seizing, and for many similar purposes. A strand is laid on the top; the ends are crossed underneath, and brought up on opposite sides, the bights taken round a bar or heaver, laid on the top, a twist is taken in them, and a marling-spike stuck through the bights, and hove upon. See also Fig. 125 (b).

A Round Seizing, Fig 128, Plate 15. Splice an eye in the end of a seizing, Fig. 126, and taking the other end round both parts of the rope, reeve it through the eye, pass a couple of turns, haul them taut by hand; then, with a marling-spike-hitch, heave these two turns well taut, by the heaver or marling-spike; pass the rest, and bind them in the same manner, making six, eight, or ten turns, according to the size of the rope; then push the end through the last turn, Fig. 127. Over these, pass five, seven, or nine more (which are termed *Riders*), always laying one less above than below. These are not to be hove too taut, that those underneath may not be separated. The end is now pushed *up through* the seizing, and two cross turns, Fig. 128, are taken betwixt the two parts of the rope and round the seizing (leading the end through the last turn), and hove well taut. If the seizing be small stuff, a *Wall Knot* is cast on the end; but if spun-yarn, an over-hand knot. When this seizing is clapped on the two ends of a rope, it is called an *End Seizing.*

SEIZINGS, ETC.

If upon the bight, as in the figure, an *Eye Seizing*, and if between the two others, a *Middle Seizing*.

A Throat Seizing, Fig. 130, Plate 16, is put on when ropes cross, and is passed with riding turns, but *not* crossed. A bight is formed, Fig 129, by laying the end (a) over the standing part (b). The seizing is then clapped on; the end put through the last turn of the riders, and knotted. The end part of the rope, Fig. 130, is turned up and fastened to the standing part, as in the figure, with a *round seizing*. This is used for turning in dead-eyes, hearts, blocks, or thimbles.

The riding turns are one less in number than the under ones, as 7 and 6, 10 and 9, &c.

A Round Seizing, second method. Splice an eye in the seizing, pass it under both parts of the rope, and reeve the end through the eye; slack up, lay hold of the upper turn and end part with your left hand, and under turn with your right, and work the seizing round left-handed until enough turns—six, eight, or ten—are wound round, Fig. 131, Plate 16; then reeve the end back between the upper and under turns, and bring it up through the eye; heave each turn taut separately, keeping the eye on the left-hand side, Fig. 132. When you have hauled the end taut through the eye, pass the riding turns round, in the same direction as at first—one in number less than the under turns, and haul hand-taut, Fig. 133. When all on, pass the end down between the last two parts of the upper side of the inner turns, between both parts of the rope, and pass two round turns, crossing all parts of the seizing, Fig. 134; then slue the rope over, and finish off with a reef-knot, Fig. 136, on the under side, or as in Fig. 135.

Racking Seizing, Fig. 137, Plate 16. In seizing off wire rigging, or turning in rigging with the patent dead-eyes, the lower turns of the throat seizing are, or should be, passed with *racking turns*. The first turn is passed round both parts of the rope like a round seizing; it is then dipped between both parts, and the remaining turns are passed as racking turns—over and under. When the requisite number are on, reeve the end down inside the last turn, bring it up outside, and pass the outside turns back towards the eye of the seizing, allowing them to sink in between the parts of the first turns; by which it assumes the appearance of a flat seizing, as there are in reality no *riding* turns. When down to the eye, dip the end down between the first two turns, and finish off with a reef-knot.

A Flat Seizing is commenced the same as a round seizing, but, on the end being rove through the eye, it is finished off at once with a reef-knot without any riding turns.

PLATE 16

Fig. 129

Fig. 130

Fig. 131

Fig. 132

Fig. 133

Fig. 134

Fig. 135

Fig. 136

Fig. 137

Fig. 138

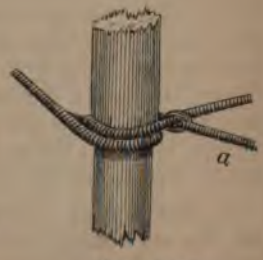


Fig. 139

PLATE 17

Fig. 140

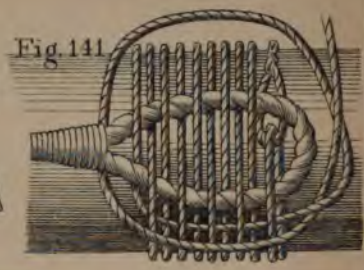


Fig. 141

Fig. 142

Fig. 144

Fig. 145

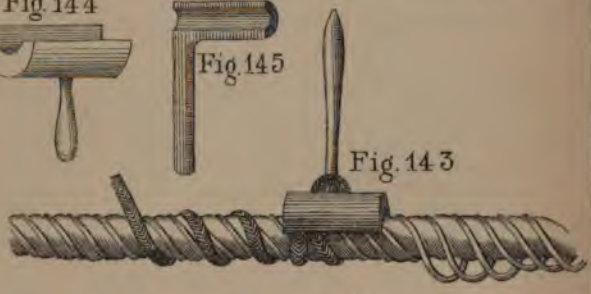


Fig. 143

Fig. 147

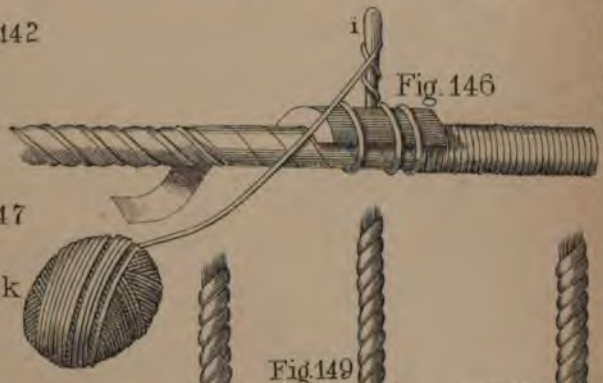


Fig. 146

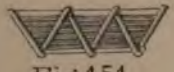


Fig. 151

Fig. 148

Fig. 149

Fig. 150

WORMING, ETC.

A Cuckold's Neck, or Half Crown, is formed as Fig. 138, Plate 16, with a round seizing. Used when ropes are fitted for going over a spar, as the back ropes, sometimes called gob-ropes, for the Dolphin Striker. Fig. 139, *a*.

A Rose Seizing, or Rose Lashing, Figs. 140 and 141, Plate 17, is used when rigging is lashed to yards, &c. Such as foot-ropes, truss-straps, &c. It is passed alternately over and under each part of the eye, and the end passed around the crossings instead of cutting it off.

Stopping, is fastening two parts of a rope together, like a round seizing, but not crossed.

Nippering, is making fast the two parts of a laniard or tackle-fall, while the purchase is fleeted. The turns are taken cross-ways, Fig. 142, Plate 17, between the parts to jam them; and frequently a *round turn* is taken over the laniard, before every cross: these are called *racking* turns. Riders are passed over these, and the ends fastened with a REEF KNOT, if they are to remain.

WORMING—SERVING—POINTING—GRAFTING—MOUSING.

Spun-Yarn is used for *Worming, Serving, Seizing,* &c., as a general rule, but *Hambroline, rounding,* and small seizing stuff is frequently substituted.

Worming a Rope is filling up the division between the strands (called the *lay* of the rope) by passing spun-yarn, &c., along them, Fig. 143, Plate 17. This is done in order to strengthen it, for various purposes, and to render its surface smooth for parcelling. After being passed by hand, worming is hove on by a soft strand knotted and taken round the rope; a bolt is then passed through the bights, and the strap twisted up and hove round the rope, which tautens the worming as it proceeds. With very large rope, the worming requires *backing* on each side with smaller stuff, in order to fill it up properly. If the rope is not to be served, a seizing, snaked, should be put round the worming at intervals, to keep it in its place, as it is liable to work slack.

Worming is in length about once and a half the length of the rope to be wormed, for each piece.

Parcelling a Rope, is wrapping strips of old canvas round it, well tarred, with edge overlapping, which prepares it for serving and secures it from being injured by rain-water lodging between the parts of the service when worn. Fig. 146, Plate 17. Parcel with the lay, if service is to be used, otherwise against it.

SERVING—WHIPPING.

Service is put on to protect the rope from chafe and the influence of weather. It is clapped on by a wooden mallet, Fig. 144, Plate 17, made for the purpose. The mallet is round at the top, but has a groove cut in the head of it to receive the rope, that the turns of the spun-yarn may be passed with ease and despatch. The rope is first bowsed hand-taut by a tackle, then wormed. The end of the spun-yarn for the service is laid upon the rope, and two or three turns passed round the rope and over *it* (the end), hauling them very taut. The mallet is laid with its groove upon the rope, Fig. 146; a turn of the spun-yarn is taken round the rope and the head of the mallet, close to the last turn which was laid by hand; another is passed in the same manner, and a *third* also on the *fore* part of the mallet, leading up round the handle (i), which the rigger holds in his hand. *The service is always passed against the lay of the rope*, so that as the latter stretches, the tension of the former is not much decreased. A boy holds the ball of spun-yarn (k), at some distance from the man who is serving, and passes it round, as he turns the mallet, by which he is not retarded in the operation. The end is put through the three or four last turns of the service, and hauled taut.

A serving board, Fig. 145, is used for small jobs.

Two men can worm, parcel and serve two fathoms of twelve-inch rope in an hour.

Spike Serving is used when you have a small eye or similar piece of gear to serve. The turns are passed by hand and each is hove taut separately by taking a marling-spike-hitch over a marling-spike, and with the point prizing it against the rope until the service is taut.

Whipping a Rope, Fig. 147, Plate 17, is done to prevent the end from fagging out. Place the end of the whipping stuff in the lay of the rope, pointing up towards the end, and pass a few turns round the rope binding the end of the whipping; then laying the other end *on* the turns already passed, pointing downwards, pass the remainder on the bight, hauling through on the end part and cutting off.

The "Square" and "Sharp-up" marks on braces are put on in a similar manner; the last turns being passed slack, and the end stuck through.

A Sailmaker's Whipping is put on with a needle and twine—a reef point has such a whipping. Pass a stitch through the point, take several turns, stick through again, and pass cross turns from one end of whipping to the other in the direction of *the lay of* the rope.

CROWNING—POINTING—SNAKING.

Crowning the end of a Rope is a rough substitute for a whipping. With the three strands form a crown, then stick the end once or twice as in splicing.

To Crown a Hawser. Put a stout whipping on the hawser, a sufficient distance from the end to allow for crowning. Unlay the strands to the whipping, and lay the three *inside*, or heart strands up together. Then form the crown with the three *outside* ones, taking them above, and covering the remaining three, which, with the heart strands, should be whipped, and cut off even. Lastly, worm the ends of the crowning strands back into the lay of the hawser, and clap stout smooth seizings close up to the crown, and at the extremity of the worming. Sometimes an artificial eye is formed with the inner strands.

To Point a Rope, Figs. 150 and C, Plate 17. Unlay the end of a rope as for splicing, and stop it. Take out as many yarns as are necessary, and make nettles: (this is done by taking separate parts of the yarns when split, and twisting them.) Comb the rest down with a knife, Fig. 148. Make two nettles out of every yarn which is left; lay half the nettles down upon the scraped part, and the other, back upon the rope, Fig. 149. Take a length of twine, which call the *Filling*, and pass three turns very taut, jamming them with a hitch at (a). Proceed, laying the nettles backwards and forwards as before, and passing the filling. The ends may be whipped and snaked with twine, or the nettles hitched over the filling, and hauled taut. The upper seizing must also be snaked, Fig. 150. The pointing will appear like Fig. C: a small becket is often worked at the end, when the rope is large (g). If the tapered part be too weak for pointing, a piece of stick may be put in, proceeding as before.

Snaking is for the better securing of a seizing, which is passed round the single part of a rope, and therefore cannot be crossed. It is done by taking the end part under and over the lower and upper turns of the seizing, Fig. 151, Plate 17.

Pointing a Large Hawser. Clap on a whipping of three-yarn nettle-stuff, snaked. Open out the strands, lay the heart up three-stranded, and splice a becket into it, which has previously been eye-spliced into its own part. Lay the outside yarns up into five-yarn sennet; use, for filling, a two-yarn fox; and continue as already shown—Fig. 152, Plate 18.

Cross Pointing. Commence as for straight pointing, and, having laid the nettles, one up and one down alternately, bring an upper nettle down to the *right* of its corresponding lower one,

lay the lower one up, and work in this way once round to the right; commence again, and bring what are now the upper ones down to the *left* of the lower nettles, lay the lower ones up, and so work round backwards; then, bring them down again to the right, and so go on. Finish off with two turns of straight pointing as in Fig. 154, Plate 18.

Hitching is a very convenient method for covering boats' awning-stanchions, &c., and, is similar to grafting. The nettles to be used are middled, laid along the article to be covered, and secured in their places with a turn of filling. If working from one end, as in the cut, Fig. 155, Plate 18, all the nettles are taken up; if working from the centre towards the ends, the nettles on each side of the filling supply their own end. The turn of filling being passed and hitched as in pointing, commence hitching the nettles round the filling, hauling each taut separately, working to the left, keeping the filling taut, and going round and round. If what you are covering contracts in circumference, you must leave out a nettle occasionally, and cut it off; and should it increase, lay fresh ones in. It is finished off by keeping the bights of the last round slack until you have passed a couple of turns of the filling and hitched it as in finishing off pointing, when in the same manner haul the bights close down, and cut the ends off.

Grafting a Rope, Fig. 157, Plate 18, is done by unlaying the two ends of a rope, placing the strands one within the other, as for splicing, Fig. D, and stopping them at the joining. The yarns are then opened out, split, and made into nettles, as before, for pointing. The nettles of the lower part (a), Fig. 156, are divided, the filling passed as before, and pointed over the rope. Proceed with the nettles of the upper part in the same manner, snaking the seizing at each end, Fig. 157. Straps of blocks in former times were often grafted instead of using the short splice, particularly those for the quarter deck. This is by no means so secure as the splice, for if the pointing be worn by wet and friction, the strap may give way; it is therefore better, that the straps of blocks which are to be pointed for neatness, and without a splice, should be made *Selvagee* fashion, all the parts of which bear an equal strain, and if the pointing give way, the strap will hold.

The nettles in the plates are much too large, and only a few represented, to avoid confusion.

This method of grafting has become obsolete.

Grafting, as understood now, is when a strap, ring-bolt, or other article, is to be covered over entirely. It is done as in

PLATE 18

Fig. 152

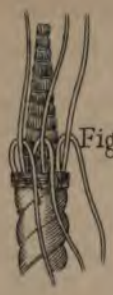


Fig. 153

Fig. 154

Fig. 155

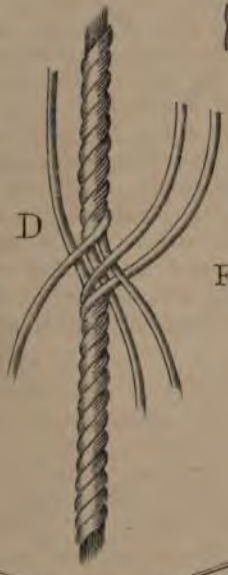


Fig. 156

Fig. 157

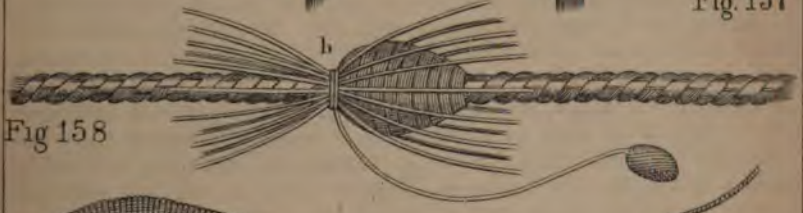


Fig 158

Fig. 159

Fig 160

pointing, using instead of the rope-yarn nettles, log-line, or fishing-line, according to the size required.

A Mouse for a Stay, Fig. 158, Plate 18, is generally raised with spun-yarn, taking a number of turns, heaving them well taut, jamming them with rope-yarns laid under and over, alternately, and then parcelled and pointed. It is, however, found that the parcelling alone is sufficient, which is tapered and marled down, according to the shape required. Fig. 158 represents the mouse made with parcelling. Nettles for pointing, made of hambroline, &c., according to the size of the stay, are middled, laid with their bights just above the head of the mouse at (b), and the filling passed round, proceeding as before mentioned in pointing. As they rise on the mouse, more nettles are added; and when past the thickest part, they are decreased. They are frequently worked a little distance below the mouse, on the stay, according to fancy; the service of the stay is taken over their ends, to secure them; the filling is houseline, marline, &c.

The mousing on stays is altogether obsolete.

An eye being worked in the upper end of a lower stay, the lower end was rove through it, till brought up by the mousing, thus forming a collar. Fig. 159, Plate 18.

This style of rigging is only to be met with now in some of the models of old ships.

Puddings for the Yards or Masts, Fig. 160, Plate 18, are made by splicing an eye in each end of a piece of rope, according to the size intended, then serving it over with spun-yarn, increasing the turns from each end towards the middle; which tapering gives it the shape of the figure. If it be for a mast, it is pointed over for neatness—a laniard or lashing is spliced into one of the eyes.

The Pudding is now rarely seen.

Where hemp cables are used, the rings of the anchors are well parcelled with tarred canvas, and then wrapped round with twice-laid stuff, which is called PUDDENING THE ANCHORS. It is done thus:

A number of lengths are cut, each three times the diameter of the ring. These are laid on the ring and stopped by a temporary seizing in the middle (a), Fig. 161, Plate 19. They are laid by hand as far as (b); when a turn or two of rat-line stuff is taken round, and a heaver (b) being put through it, it is hove well round, which stretches all the turns of the pudding or wreath, making them lie taut and even. A seizing is clapped on within the heaver and snaked; the heaver is then taken off.

The parts are then laid and hove in the same manner to (c), Fig. 162, Plate 19, where another seizing is clapped on. The same operation is performed on the other side to d and e, when it will appear like the figure, the temporary seizing being taken off. The ends of the pudding are then opened out (f) and well tarred.

The Buoy is a kind of cask, made in the form of Figure 163, Plate 19. It is slung, for the purpose of bending one end of the buoy rope to, the other end being fixed to the crown of the anchor. Nine times the length of the buoy will make the slings and hoops.

These are hove out, parcelled and served. The slings have an eye spliced in each end. The lower hoop (g) is rove through the eyes of the upper slings (h), which are taken under the upper hoop (i): this is rove through the eyes of the lower slings (k), which are taken under the lower hoop (g). The ends of the hoops are spliced together. A tackle is hooked to the bights of one pair of slings: the bights of the other being put over a timber-head, they are bowsed well out, and the hoops beat down: the bights at each end are then seized with a round seizing, and double crossed. There is often a thimble (m) seized in the bights, round which is another thimble, and to it the buoy rope is bent. A laniard (l) is spliced to the upper eye of the slings.

By a second method, four pieces of rope are middled, and the bights of two laid over each end, forming the same number of legs as in the first; but no straps are used. Each leg of one end is spliced into the next right-hand leg of the other end; scores are cut in the buoy for their reception, and a seizing round the eye tautens them up. Fig. 164.

In the navy, all buoys are now made of iron.

A Dolphin, Fig 165, Plate 19, is made in the same manner that the pudding was begun, having an eye in each end; but no service raised. It is wormed and parcelled, to make the surface even, and then pointed over, Fig. 165. In one end is spliced a lashing, or laniard, and when the two ends are lashed round the mast, &c., the lashing is passed crosswise, over and under one eye, then over and under the other, and the end part afterwards taken in a circular form round the crossing. This called a *Rose-lashing.*

The Dolphin is now seldom used, but a rope treated in the same manner, with mousings raised on it at regular intervals, is sometimes put around a Launch, just below the gunwale outside and secured there as a sort of permanent fender; this also is called a Dolphin.

PLATE 19

Fig. 161

Fig. 162

Fig. 164

Fig. 163

Fig. 165

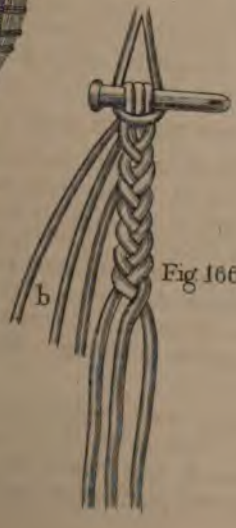


Fig. 166

Fig. 167

FOXES—GASKETS—TURK'S HEAD.

Foxes for gaskets, &c., are made by taking a number of rope-yarns, from three upwards, according to the size intended, and twisting them on the knee, rubbing them well backwards and forwards with a piece of canvas. *Spanish* foxes are made by twisting single rope-yarns back-handed in the same manner.

Gaskets, Fig. 167, Plate 19, are made by taking three or four foxes, according to the size, middling them over a pin, &c., and plaiting the three or four parts together for the length of the eye, Fig. 166. The plaiting is formed by bringing the outside fox on each side alternately over to the middle. The outside one is laid with the right hand, and the remainder held and steadied with the left. When this is done, take the other parts (b), (having shifted the eye part so that it lies over the bolt, Fig. 167), and work the whole together in the same manner; add another fox at (a), and work it for a convenient length, then diminish it towards the end, taking out a fox at proper intervals. When finished, one end must be laid up, the others plaited, and then the one hauled through.

Sea gaskets or *furling lines* are made in this way, though not tapered.

Turk's Head. Take two round turns round the rope, Fig. 168, Plate 20, pass the upper bight down through the lower, and reeve the upper end down through it, Fig. 168 (a); then pass the bight up again and reeve the end over the lower bight, and up between it and the upper one, Fig. 168 (b); dip the upper down through the lower bight again, reeve the end down over what is now the upper bight, and between it and the lower, Fig. 168 (c); and so proceed, —working round to your right until you meet the other end, when you pass through the same bight, and follow the other end round and round until you have completed a plait of two, three, or more lays, as you wish. Fig. 168 (d), shows a Turk's head of two lays.

Turk's Head worked into a Rope. This is done when the knot has to resist a strain, as the rung or round of a Jacob's ladder. You middle the marline or nettle-stuff that you are working with, and splice a second piece into the centre so as to form a third leg; then pass an end through the rope, and haul it through to the junction of the third leg, which reeve through the third strand of the rope, bringing an end out between each strand, Fig. 169, (a) Plate 20. Then crown the ends round the rope, left-handed; slue round, and crown them back, right-handed, and the knot will appear as in the Fig. 169. Follow each part round with its own end, cut the ends off, and it will appear like a Turk's head. With four-stranded rope use four ends

SELVAGEES—REEFING BECKETS, ETC.

A Selvagee is made by warping rope-yarn, spun-yarn, or small stuff, according to the size required, and marling down as in Fig. 170, Plate 20.

A small selvagee may be made by warping rope-yarn around two marling-spikes, stuck in the holes of a grating at the proper distance apart.

Large ones are sometimes made of small stuff, for getting in lower masts, and are called garlands.

As selvagee straps are soft and pliable, they are the best for clapping on rigging, spars, &c., as in Figs. 171 and 172.

For the same reason, nippers when not of iron, and stoppers for braces, &c., are made in a similar manner, as in Fig. 173.

Selvagees may be used for various purposes. A very neat and expeditious way of bending studding-sail halliards is to use a strap, as in Figs. 174 and 175.

Very neat straps for blocks, may be made of selvagees.

Reefing Beckets, Fig. 177, Plate 21, are made like sennit, after a variety of designs.

These points may be made of manilla-yarns, or four-yarn spun-yarn, with four or five parts in the eye, and worked down with seven or nine parts; the length of the spun-yarn on the two parts to make a point, is once and a half the length of the point to be made. The eye is made around a toggle which remains in. If fitted to go around the jack-stay, plait down six inches from the toggle, then separate the foxes and plait an eye eight inches long, then plait down nine inches solid, whip the end with twine and it is finished.

Sometimes the points or beckets are fitted to go round the yard, with a short eye to go over the toggle, and the toggle part is seized to the jack-stay. To make these plait down from the toggle four inches longer than the round of the yard, where it would be placed, separate the foxes and plait an eye three or four inches, according to size of sail, then plait down solid four inches, another eye eight inches long, and solid again for nine inches, whipping the end with twine. When rope points are used, they are made as follows, supposing them to go round the yard: Cut the rope, which should be four-stranded, about three feet and a half longer than the round of the yard. Splice one end round the toggle, put a whipping on the rope about four inches longer than the round of the yard from the toggle; then divide the rope in two up to the whipping, and form an eye four inches long, with two strands on each side, then lay up four *inches solid,* and form another eye eight inches long; then lay

PLATE 20

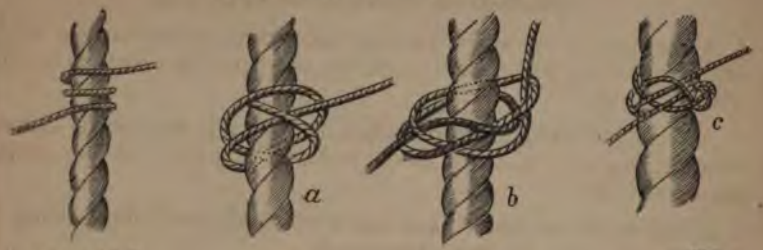


Fig. 168

Fig. 169

Fig. 170

Fig. 171

Fig. 172

Fig. 173

Fig. 174

Fig. 175

PLATE 21

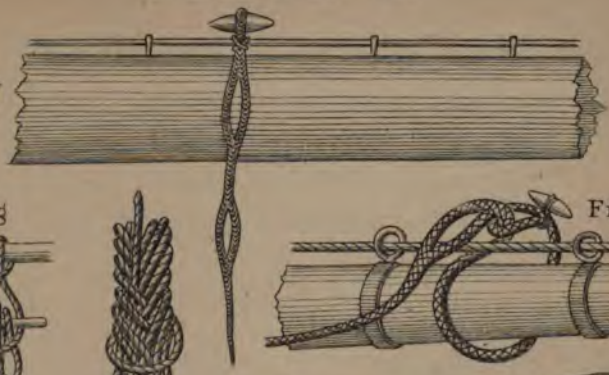


Fig. 177

Fig. 178

Fig. 179

Fig. 176

Fig. 180

Fig. 181

Fig. 182

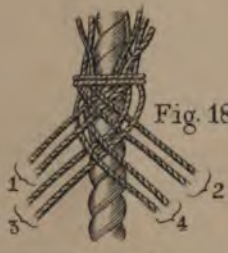


Fig. 183

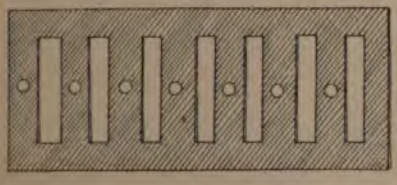


Fig. 185

Fig. 184

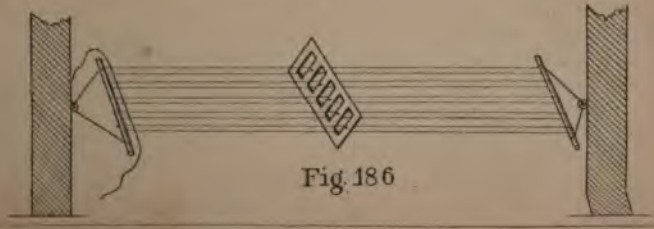


Fig. 186

up nine inches solid, and whip the end with twine. Now finish the eyes by taking a strand of the same sized rope four times the length of the eyes, pass it through the rope at the lower part of the eye, and lay one end up each side of the eye to form a three-stranded rope, splice them into the standing part and it is finished, as in Fig. 167, Plate 21.

Common Sennit is made with an odd number of nettles. If, however, an eye is to be formed, you commence with an even number—one being a short one; and after the eye is formed, the short end is worked in, or, if too long, left out and cut off—leaving an odd number to go on with. We will suppose that a reef-point is to be made of seven parts of spun-yarn:—Cut off four lengths (one being but little more than half the length of the others), middle them, toggle the bights through a becket triced up before you, halve the nettles, lay the right-hand nettle over the next one to it, bringing it over to the left, making three now on your left, and one on your right; Fig. 178, Plate 21, bring the outside nettle on the left over two, which will equalize them again; then the right over one, left over two, and so on alternately till you have worked length enough for the eye; next bring all eight parts together, halve them, and go on as at first—right over three, and left over four. When two or three lays are worked in this way, leave out the short end, and continue with seven parts—right over three, and left over three in succession. Finish off by forming a bight of the left hand nettle when you bring it over, laying the end up; and as you work the remaining nettles in, point them down through this bight; and, when all are in, secure them in their places by hauling the bight taut through upon them, and cutting the ends off, Figs. 179 and 180.

French Sennit, like common sennit, is made with an odd number of nettles. If about to make a harbor gasket for a royal yard in this manner, of nine parts of nettle-stuff, cut off five lengths (one being a short one), middle them, put a seizing round the bights to form the eye, which marl down, and serve over; then bring all nine parts together (having left out the short one after the seizing was passed), and divide them, with five to the right, and four to the left; weave the outside one on the right, over and under the nettles on its own side, bringing it out to the left, then do the same, with the outside nettle on the left, and lay it out to the right, when there will be again five on the right, and four on the left, and so continue.

Harbor gaskets are made in this way, and also the *tackers* which nail on the topsail and lower yards for the head-earings to haul out to, as in Fig. 181, Plate 21.

SENNIT—SWORD MAT.

Round Sennit is used for man-ropes, yoke-lines, &c., Figs. 182 and 183, Plate 21. Stretch a heart of small rope taut along between two belaying pins, or other convenient fixture; take 8 (12, 16, or more) nettles, put a whipping round the heart and ends, to hold them, divide them into fours of 2 (3, 4, or more) parts each; then lay No. 1 pair over the heart, to your left; then No. 2 to your right, crossing the first pair; next No. 3 pair under all to the right, and over No. 2; No. 4 round under all to the left, and over No. 3; then No. 1 round to the right, under No. 2, and over 4, 2 round to the left, under 3, and over 1; and so on, always bringing the upper pair on the opposite side, to cross over the pair last passed. Finish the end off by pointing the heart with the nettles made into smaller ones; and finish the top by walling and crowning the heart, covering it with duck to round it, then double-walling and crowning the nettles over the heart knot, previously whipped underneath, with a Turk's head to cover the whipping. Or, after forming the knot of the heart, and covering it, and putting the whipping round the nettles underneath, you may cut them off, and cover the knot with Turk's heading of mackerel line, begun very slack, and spread over the knot, by passing with a sail-needle, as many lays in the plat as will be required to cover the knot.

Square Sennit is used for the same purposes as round sennit, and also by engineers, as packing for their pistons. It is made somewhat in the same manner as round sennit, but without a heart. Nettles are used in the same ratio, increasing by fours, but are worked singly instead of in pairs. Having put a whipping round the (eight) ends, divide the nettles, and lay half on each side; bring the uppermost left-hand nettle round underneath all, and up inside two, and over two of the right-hand ones—crossing over the latter ones to the left, and making four on each side again; then take the uppermost of the right-hand nettles, pass it underneath, and under two, and over two of the left-hand ones—still keeping four on a side, because the nettle taken up always comes round to its own side again. To proceed, take the upper nettle on each side alternately, and finish off as you finish round sennit. One man can make a fathom and a half of 9-yarn sennit in an hour. Fig. 184, Plate 21.

Sword Mat. At a distance apart, equal to the length of the mat, sling a couple of bars in a horizontal position. Hitch one end of the warp to the bar at the end on which you intend to terminate the mat; take up the loom, which is made of a sheet of copper perforated with holes and slits alternately, Fig. 185, Plate 21, reeve the other end through the first hole, over and under the bar at which you intend to begin, back through the first *slit, under* and over the other bar; and so wind off as many

PLATE 22

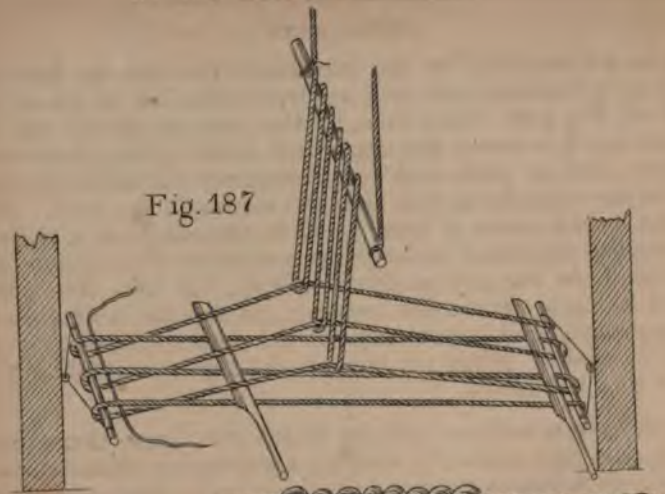


Fig. 187

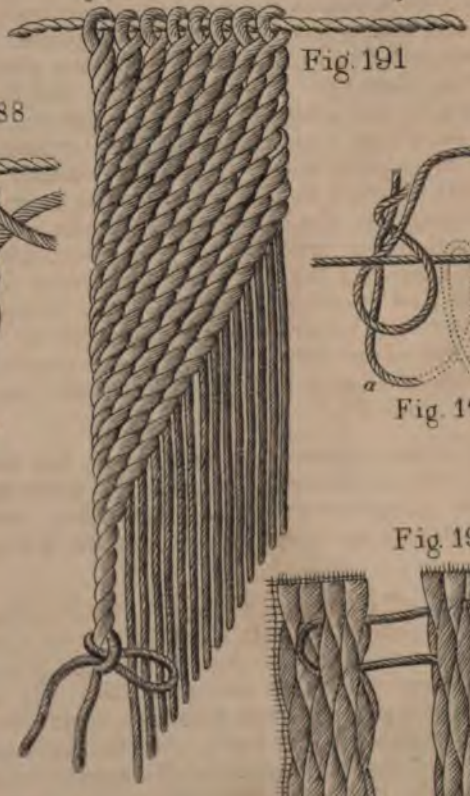


Fig. 191

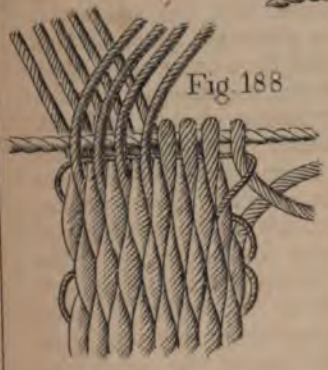


Fig. 188

Fig. 192

Fig. 189

Fig. 190

SWORD MATS.

parts as are required for the breadth of the mat, the last turn being rove through a slit, and secured to the bar at which you finish off, Fig. 186. This done, lift the loom up, middle the filling, and lay it between the upper and under parts; then lower the loom, and the parts that were lowermost will rise in the slits, become the uppermost, and thus put a cross in the warp. Next put the sword, made of hard wood in the shape of a knife, in between the upper and under parts, and drive the crossing close up towards the bar, and harden it well up, Fig. 187; then pass a turn of filling to secure the crossing, reeving the ends through contrary ways, haul it taut, take out the sword, lift the loom up, and go on again. When you come to the last turn of filling, half-knot it with two turns.

If you have to make a mat for which your loom is not large enough, you rig a fiddle, by slinging a handspike athwartships to the main-deck beams overhead; pick up every other part of the warp, and with a piece of nettle-stuff passed over the handspike with *two round turns*, and rove round the alternate parts of the mat, trice them up. The upper parts will thus cross the under parts before and abaft the fiddle, and you will require two swords. Reeve the filling, and secure the first crossing already formed, by the parts being triced up, in the ordinary manner, hardening it up with the first sword; now, put the second sword in between the crossing and the bar abaft the fiddle, give the mat a shake, to disengage the parts, and with the sword lift the upper ones up. The crossing will thus be extended before the fiddle; so withdraw the first sword, put it in abaft this crossing, drive it up and secure it with a turn of filling; again lift up the fiddle, keeping the second sword fast (which is never removed); a crossing is again formed at each end; and you again repeat the operation. Fig. 187, Plate 22.

With a heavy boom-mat five or six feet wide, you require a second fiddle underneath, to rouse the parts through. A couple of hands jump down on the handspike; and the upper one, which is triced up by a couple of jiggers, is lowered at the same time.

To finish off or *selvage* the mat:—After passing the last turn of filling, and securing it with a half-hitch with two turns, you lay the laniard across on the top of the filling, and commence unreeving again the front row of nettles, one at a time, beginning on the right. As you withdraw them you bring the corresponding nettle, at the back, over the laniard and filling, and reeve it back through the hole left vacant by the one hauled out. See Fig. 188, Plate 22. Go right across and haul the bights taut down to the laniard. On slueing the mat round, you will

find that this will leave the second row of filling bare; so go on withdrawing the same ends again, along the second row, and pointing the same reeving ends, as at first, through the holes the others came out of, covering the filling, and complete four or five rows of this in the same manner. Then, to cover the last row of filling, and to secure the ends of the nettles, you lay them up and down alternately, the long ends that you have withdrawn going up, and the short ones that you have been reeving, laying down; haul them taut, beat them in, and then tuck them under the bights of the next lay, the lower ones left-handed through the bights to the right, and the upper left-handed to the left. Beat the mat down and cut the ends off. Fig. 189.

To finish off by *shouldering*, as for the upper part of a lower rigging mat (when, after reaching the top of the dead-eye, it is contracted in order to cover the shroud for a few inches), you leave as many nettles out at each edge of the mat as will reduce it sufficiently, then lay the laniard (to secure the mat above the dead eye), along the top of the last turn of filling, and go on working on the centre nettles that you have retained, as far up as you intend to go. Knot the filling, tease the ends of the nettles out a bit, place them round the shroud and serve them over. The ends that you left out, on each side, you finish off by selvaging, as already explained. As the rigging stretches, turn the bottom of the mat up, with the end inside. Permanent coverings for laniards are not approved of.

Splicing a Sword Mat. Unlay six or eight inches of each mat, open the ends out, marry them together, laying one up and one down flat along the mat, withdraw the nettles on one side of one (No. 1) mat, and point the nettles of the other mat (No. 2) through the holes they came out of; all ends will then disappear from that side, and there will be four rows of ends on the other. Slue over, pick out the proper nettles of the side, which have been married together, withdraw the ends belonging to No. 2 mat, and introduce the corresponding ends of No. 1 through the holes. The same operation has now been performed on each mat, and on each side there are now two rows of ends; marry those together on each side, laying one up and one down, and go on splicing by withdrawing and reeving, for two or three rows more in each mat. Leave off with the ends all out on the same side, and finish off with selvaging.

A Cobler's Stitch is used for joining the sides of mats together. Fig. 190, Plate 22. Take a filling of roping twine, middle it, and reeve each end through two bights in each mat (if a heavy mat, through three bights at each edge), then reeve the lower-*most* end back through the same bights as the upper end, which

will bring the ends out at opposite sides; draw the mats together, and reeve both ends through two turns in each mat again, passing each other through the same hole opposite ways; and so work on, like a cobbler stitching a sole. Finish off each end, by taking a hitch through a bight in the mat of the next lay above, and cut the ends off.

Paunch Mat. For heavy-rigging mats, strands of 3-in. or 3½-in. rounding would be used for foxes, with a laniard of 2½-in. Stretch the laniard along at a convenient working height, middle the foxes and lay them across it, and, commencing on the left, lay up one turn in the first pair, right-handed. Repeat this with the second pair, and lay up the nettle that comes round to the front and left, one turn with the underneath nettle of the first pair, which was brought out to the right; then lay this latter up, one turn with the other nettle of its own pair, and take a hitch with it—which do with the last two nettles on the left, each time that you work down to them, to keep the mat from unlaying again. Now commence with the third pair—take the underneath nettle round the upper one, which lay up with the underneath and right-hand nettle of the second pair, which lay up with the other one of the second pair, which lay up with the under one of the first pair, which lay up with the left-hand nettle of all, which lay up with two or three turns to prevent unlaying, round which take a hitch. So proceed until all the nettles are brought in—a second hand holding them back as you lay up, and when you have come to the last, and the full breadth of the mat is formed, go on in the same way, working down for length. When you have obtained this on the left edge of the mat, it will appear as in Fig. 191, Plate 22; and you then begin to work down square, taking a hitch with each pair as you have finished with them, to prevent them unlaying.

To selvage it, take it down, and lay it on a grating; commence with the first left-hand fox, which bring round under the next one, and lay up along the mat, laying the one that it comes round (which is the second fox) downward, and in this manner go right across; then stretch the laniard along the nettles where they cross, and hitch the ends to the grating. With the first fox laid upward take a right-hand hitch round the laniard, as in Fig. 192, and the first one down; then take the down one (a), dip it back under the laniard, and haul it taut down, another hand at the same time hauling back on the upper one, and so knot the foxes right across. When done, haul all the lower ends taut up, and, beginning on the left cross the upper nettle (which is on the left of the lower) over it, and reeve it through the bight in the mat in the immediate lay to the right, bringing the end out to the left (rove left-handed). Beat the

hitches down, and cut the ends off, but not close; for if left of the proper length, they will form two rows of thrums. Tuck a thrum in every third bight up, and in every other lay across, which is quite thick enough; and beat down the bights in the mat that they are rove through, each time separately.

To make a Breeches Mat. Mats of this shape are used for the collars of stays; the broad part lying over the crutch, and the legs lacing round each fork. You work the mat down square as far as you require it, then halve the foxes, and work each part down separately for the legs.

You may convert an ordinary mat into a breeches mat by cutting the midship fox across at the head, and simply unreeving it down as far as is wanted; then crossing the ends, and tucking them into adjoining bights.

To repair a Rigging Mat which has had a hole chafed through it. Stick sufficient foxes through the bights of the mat at the top of the hole, to cover it, lying well over the edges, and back clear of the hole, and middle them. Bring the left-hand fox round the next one to it, lay its end up, and the one it comes round downwards, like the commencement of selvaging; go right across and secure it by sticking the left-hand nettle, right-handed, through a bight in the mat in the edge of the hole, and the right-hand nettle, left-handed, through a similar bight, the ends of each pointing outwards; then work the next and succeeding rows as a paunch mat is worked, but working square across, laying one fox up with its next only, and securing each row as it is completed, by tucking the right and left-hand nettles in as you did with the first row. When you have thus covered the hole, stick all the ends through the bights below them left-handed once or twice, and cut them off; then slue the mat over, and either stick the broken ends into the new piece, or bring the edges together with a lacing.

Net-Making. Fill the needle, stretch the head-rope along, and begin on the left by securing the end of the twine to it. Regulate the size of the mesh by taking it over your finger, and then clove-hitching it to the head. When you have worked as far to the right as the head is intended to extend, get round on the other side of the net, and work back again; but this row of meshes, and all the subsequent ones, are formed by hitching them to the upper row with a sheet bend. When the second row is finished, shift round to the other side again, and work the third row. The last row is hitched to the foot-rope, which is weighted with leads; the head-rope is floated with corks; and side-ropes are afterwards seized on. Figs. 193 and 194, *Plate* 23.

PLATE 23

Fig. 193

Fig. 194

Fig. 195

Fig 196

Fig. 197

Fig. 198

Fig. 199

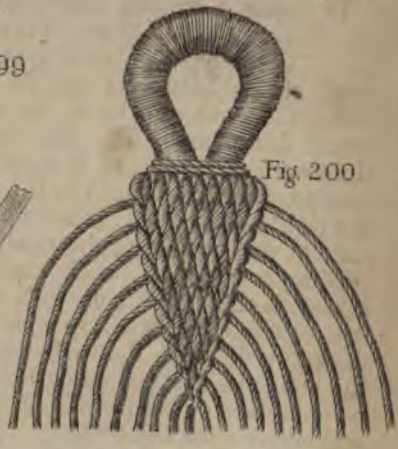


Fig. 200

Fig. 201

Fig 202

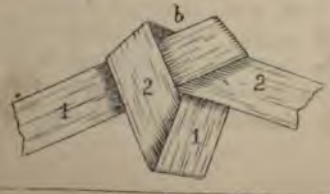


Fig. 203

NETS—FENDERS—CLEWS.

To repair a seine, cut it away until you get a straight row of meshes, and replace them as at first made.

A Shot or Treasure-Net is made like a cabbage-net; the head-rope is circular, the meshes are formed in the usual way, and the circumference of the net is reduced as you work down, by bringing two meshes into one, at regular intervals; at first, one mesh in a row; in the next row, two meshes; then taking up every fourth mesh, next every third in a row, and so on. Finish off by working a small grommet through the meshes at the bottom, to keep them together; and reeve two straps through the head for beckets, so that by hauling them apart, the mouth of the net is drawn up. Fig. 195, Plate 23.

Boats' Fenders. A paunch mat fender is made of a piece of mat rolled up taut, with the ends of the foxes placed in the centre; the end is sewed to the part of the mat where it terminates, and the edges are laced together. The laniard of the mat forms the laniard of the fender. Fig. 196, Plate 23.

The usual fender for boom-boats is made of as many parts of spun-yarn as will give it the requisite dimensions. These are middled and doubled over the laniard, and a small grommet is driven over the bights to make them snug, as in making a swab. It is then grafted over, either with sennit or foxes, and finished off as grafting is usually finished; or by crowning the end over with the foxes. Figs. 197 and 198, Plate 23.

You can crown in this way with any number of ends that are a multiple of four, by dividing them into four parts, and laying a part down on each side; then bringing 1 over on side 6, keeping the bight up, laying 6 over between 1 and 2, bringing 2 over between 6 and 5, and laying 5 over outside 2; then laying 7 over 1, under 6, over 2, and under 5; 4 over 5, under 2, over 1, under 6; then reeving 8 across, and lastly 3;—when it will be found that all the ends are secured. Haul the bights taut down, and either put a whipping round underneath, or tuck the ends under the grafting and cut them off. Fig. 199, Plate 23.

A grommet fender is merely a rope grommet grafted over.

A canvas fender is stuffed with oakum, roped at the edges, and has a small grommet sewed on the centre, to keep the chafe off.

Leather fenders are used for gigs and cutters.

Hammock Clews. Take twelve lengths of nettle-stuff, middle them, serve round all at the centre, and pass a seizing to form the eye; then lay one up and one down, as for a sword mat, bring the outside nettle on each side across for filling, and leave

it out; form the other rows in the same manner, and when reduced to two, knot the last pair. Fig. 200, Plate 23.

Spanish Clews are without plaiting, and are made by serving the nettles round below the seizing, leaving one out on each side, at regular intervals.

Sennit for Hats. Split the grass up, take a couple of lengths, cross one over the other, Fig. 201, Plate 23, double the underneath one over the upper, then the right-hand one over and under the other two, and what is now the right-hand one over two and under one, then the left-hand one over one and under two, and again the left over two and under one; then work two in on the right, and so on. Join the grass when you come to an end, by laying the end of another piece on the top, and then go on working it in; and always join on the upper side, because the under side is the proper *right* side of the sennit. Afterwards clip all the ends off, and rub the sennit down smooth with a bottle, or anything hard. Fig. 202.

The button is formed of a broader piece of grass (a). It is first doubled short over itself, then 1 under 2,—leaving a space, then 2 over 1, and down through the centre of the triangle; next 1 over 2, and down through the centre, coming out on the opposite side, and so on until an octagonal figure is formed (b).

The hat is begun by stitching the sennit to the button, Fig. 203, commencing with the end finished off with, and working round left-handed. The sennit is kept as slack as possible, and stitched through every other corner for the first few rounds; then afterwards through three thicknesses of sennit, and through every corner, the stitch being kept out of sight, by the needle being pointed underneath the strands of the sennit.

Coir Brushes. Shape a piece of hard wood for the back (stave of a salt-meat cask, for example), burn out the holes in rows with a marling-spike; and out of another piece of wood cut a *former*. Make the coir up into fillings proportionate to the size of the holes, pass the bight of the marline down through the first hole, slip it over the filling, take a turn or two round the former, and heave the bight of the filling through the hole, up to the level of the top of the back, Fig. 205; then slue over, put the filling between the notch of the former, and cut it off square, Fig. 204; dip the bight of the marline down through the next hole, and in the same manner proceed with each, until all are filled in.

To Mouse a Hook. This is done when hoisting a heavy weight to prevent the hook from straightening out, and on sails, &c., to prevent unhooking. Fig. 206, Plate 24.

PLATE 24

Fig. 204

Fig. 205

Fig. 206

Fig. 207

Fig. 208

Fig 209

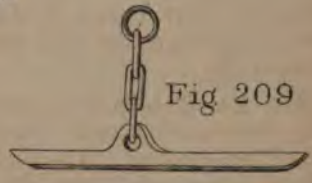


Fig. 210

Fig 211

Fig. 212

SLINGS—HOOKS, ETC.

Hogshead Slings is a piece of rope about five fathoms long, and from five to six inches in circumference, with a large thimble spliced in one end and the other end well whipped. They are used to sling large casks, being more secure than can-hooks. They are put on in this manner: pass the bight over one end of the cask, reeve the end through the thimble, and haul it well taut; then take the end round the other end of the cask, and take two half-hitches round the standing part, and it is done. Fig. 207, Plate 24.

Can-Hooks are broad, flat, iron hooks, in the eyes of which thimbles are inserted. Into these thimbles are spliced the ends of a piece of rope long enough to span a cask from chime to chime. The rope is then got on a stretch, wormed, parcelled, and served. A thimble is sometimes seized in the bight.

Some can-hooks are fitted with chain, with a large iron ring in the middle. Fig. 208, Plate 24.

Gun Slings are made of chain of three-quarter-inch iron, and tested to secure proper strength; the rings are of one and a quarter inch iron. The length of the slings should exceed by one foot that of the longest gun on board. The two parts should be parcelled and marled together for a space of two feet before and one foot behind the trunnions of the longest gun, and a piece of three-inch rope spliced around both parts in the wake of the parcelling, long enough to take four or five turns round the chase of the largest gun.

A Tank Toggle, Fig. 209, Plate 24, is used when hoisting tanks. The toggle is put in the man-hole, and the yard tackle hooked to the ring. By the superior weight of one end, it is readily withdrawn. Small ones are convenient to use with empty casks.

To Sling a Cask with a Rope's-end—make a bowline knot in the yard-whip, and stick the end back so as to form a short bight, to which bend the stay-whip. Turn the bight of the bowline over its own part, and slip each bight thus formed over one end of the cask. Fig. 210, Plate 24.

To Sling a Cask with the Head Knocked in—slip the bight of the whip under the cask, take a hitch with each part over the head, and knot them together above. Fig. 211, Plate 24.

Another way, though not quite so safe, is to make a figure-of-eight knot, and slip the bight under the barrel, as in Fig. 212.

Bale or Barrel Slings are generally made of three-inch rope, and of sufficient length to go round the bale or barrel. They are similar to a long strap, spliced together with a short splice;

it is passed round the barrel and one bight rove through the other. Fig. 213, Plate 25.

They are sometimes made long enough to sling two or three barrels at a time.

A Parbuckle, Fig. 214, Plate 25, is a purchase contrived with a single rope for raising a heavy cask or other similar weight. The same kind of purchase, though on a larger scale, is used for getting on board the shear legs when masting a ship with one's own resources.

Jacob's Ladders are made of rope, as in Fig 215, Plate 25, for convenience of passing into the boats, into the rigging, &c. They lead from the spar deck to the lower rigging, to enable the topmen to get in the rigging without getting on the hammocks; On the lower booms and main brace bumpkin to facilitate getting in and out of boats; and in large ships, to the after-end of the spare topsail-yard in the chains; and also from the top-gallant mast-heads, the lower end setting up to the afterpart of the cross-trees.

Take twice the length, of four-stranded rope, the ladder is to be, and seize a thimble in the bight, having first wormed the rope; then at equal intervals, say sixteen inches, place the "*rounds*" or rungs between the strands, working Turk's heads on each side; splice a thimble in each end, and splice a laniard in the thimble. Those for the lower boom, stern, and rigging generally, have sister hooks, and hook into eye-bolts placed for the purpose.

Formerly a small line was rove through holes made in the centre of the rounds and ran the entire length of the ladder, and was called *a concluding line.*

Snaking on Backstays, &c. Seizing a small rope alternately from one stay to another, to keep either from falling if shot away. This is only done when preparing for action. Fig. 216, Plate 25.

Nettings, Fig. 217, Plate 25, are made by seizing together the bights of small ropes—such as ratline stuff—leaving uniform spaces or meshes between. The rope is first marked off at equal intervals with chalk, and neat seizings of twine clapped on. They are used in different parts of the ship for various purposes.

Jib Nettings seize to the jib guys on each side, passing under the boom, and are for the purpose of catching and holding the jib when hauled down, and to save men from falling overboard when stowing the jib in bad weather.

PLATE 25

Fig. 213

Fig. 214

Fig. 215

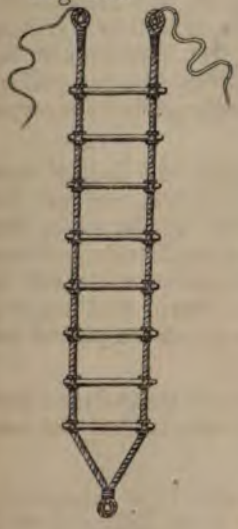


Fig. 216

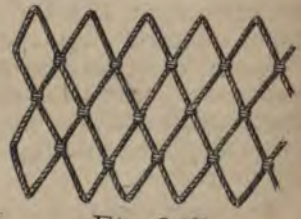


Fig. 217

Fig. 218

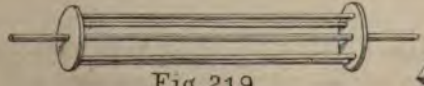


Fig. 219

Fig. 220

NETTINGS.

Staysail Netting, for stowing the foretopmast staysail in.

Boarding Nettings trice up from the rail to the ridge-rope to prevent the enemy from boarding. These, when made of ratline stuff well soaked in tar, sanded, and allowed to harden, defy the sharpest knife.

Breastwork, Gangway, Quarter, and Waist Nettings were formerly used "to keep the hammocks in the stanchions;" hence the present name of Hammock Netting.

Quarter-Deck Nettings were formerly stretched over the deck like an awning to prevent spars, &c., from falling on the heads of the officers, in time of action.

CHAPTER III.

OF THE LOG-LINE AND HALF-MINUTE GLASS.

VARIOUS methods have been proposed for measuring the rate at which a ship sails; but that most in use is by the Log and Half-Minute Glass.

The Log is a flat piece of thin board, of a sectoral or quadrantal form, Fig. 220, Plate 25, loaded, on the circular side, with lead sufficient to make it swim upright in the water. To this is fastened a line, about 150 fathoms long, called the *log-line*, which is divided into certain spaces called *knots*, and is wound on a reel, Fig. 219, which turns very easily. The Half-Minute Glass is of the same form as an Hour-Glass, Fig. 218, and containing such a quantity of sand as will run through the hole in its neck in half a minute of time, or twenty-eight or fourteen seconds.

The making of the experiment to find the velocity of the ship, is called *heaving the log*, which is thus performed:—One man holds the reel, and another the half-minute glass; an officer of the watch throws the log over the ship's stern, on the lee side, and when he observes the stray line is run off (which is about ten fathoms, this distance being usually allowed to carry the log out of the eddy of the ship's wake), and the first mark (which is generally a white rag) is gone off, he cries, *Turn;* the glass-holder answers, *Turn;* and watching the glass, the moment it is run out, says, *Up.* The reel being immediately stopped, the last mark run off shows the number of knots, and the distance of that mark from the reel is estimated in fathoms. Then the knots and fathoms together show the distance the ship has run the preceding hour, if the wind has been constant. But if the wind has not been the same during the whole hour, or interval of time between heaving the log, or if there has been more sail set or handed, a proper allowance must be made. Sometimes, when the ship is before the wind, and a great sea setting after her, it will bring home the log. In such cases, it is customary to allow one mile in ten, and less in proportion if the sea be not so great. Allowance ought also to be made, if there be a head sea.

This practice of measuring a ship's rate of sailing, is founded upon the following principle—that the length of each knot is the same part of a sea mile; as half a minute is of an hour.

LOG-LINE—TIME-GLASSES.

Therefore the length of a knot ought to be $\frac{1}{120}$ of a sea mile; but, by various admeasurements, it has been found that the length of a sea mile is about $6086\frac{7}{10}$ feet;* hence the length of a sea knot should be 51 feet. Each of these knots is divided into 10 fathoms, of about 5 feet each. If the glass be only 28 seconds in running out, the length of the knot ought to be 47 feet and 6 tenths. These are the lengths generally recommended in books of navigation; but it may be observed, that, in many trials, it has been found that a ship will generally overrun her reckoning with a log-line thus marked; and, since it is best to err on the safe side, it has been generally recommended to shorten the above measures by 3 or 4 feet, making the length of a knot about $7\frac{1}{2}$ fathoms, of 6 feet each, to correspond with a glass that runs 28 seconds.

In heaving the log, you must be careful to veer out the line as fast as the chip will take it; for if it be left to turn the reel itself, it will come home and deceive you in your reckoning. You must also be careful to measure the log-line pretty often, lest it stretch and deceive you in the distance. Like regard must be had that the half-minute glass be just 30 or 28 seconds; otherwise no accurate account of the ship's way can be kept. The glass is much influenced by the weather, running slower in damp weather than in dry. The half-minute glass may be examined by a watch, with a second-hand, or by the following method:—Fasten a plummet on a line, and hang it on a nail, observing that the distance between the nail and middle of the plummet be $39\frac{1}{3}$ inches; then swing the plummet, and notice how often it swings while the glass is running out, and that will be the number of seconds measured by the glass.

Both lead and log-line should be marked when wet.

The time-glasses in general use are 28 and 14 seconds, called, respectively, the "long" and the "short" glass.

The Patent Log is now in constant use, especially on board steamers. It should be rigged out by a spar, so as to clear the wake, and care taken to haul it in whenever the ship is stopped.

The following is a description of Massey's Patent Log, used in the United States Navy:

It is composed of a brass wedge-shaped box, having within three cogged wheels, acting on each other in such proportion that a total revolution of one completes a division of the next

* A statute mile is 5.280 feet. To convert sea miles into statute miles, multiply the former by 1.153. To convert statute miles into sea miles, multiply by the decimal .868.

(or one twentieth), a revolution of the next, one eighth, registering thus from one hundred and sixty miles to tenths, and decimal parts; the action is by the rotation of a spindle with four spirally-fixed wings (termed the rotation, or fly), which turns an endless screw in the box, acting directly on the decimal wheel. It is towed astern by a stout lead line of sixty fathoms, and is registered every time the course is changed, angles taken, &c, but should not be reset until the twenty-four hours have elapsed, the ship anchors, or goes less than three knots—when it becomes uncertain from not towing horizontally.

When great accuracy is required it is well to use two logs, putting one overboard as the other is hauled up, as when the course is changed, etc.

The Ground Log, is the common log-line with a lead attached, and is used in tide-ways and currents, on soundings, to ascertain the ship's speed over the ground.

CHAPTER IV.

ROPE.

THERE are four varieties of rope in the United States naval service: that made of the fibres of the hemp plant; the Manilla rope, made of the fibres of a species of the wild banana; hide rope, made of strips of green hide, and wire rope.

In some countries, ropes made of horse hair, of the fibrous husk of the cocoanut, called coir-rope, and of tough grasses, are quite common. In our own country, rope has been made from the flax and cotton plants; the metals have also been put in requisition, copper wire rope being used for particular purposes, principally for lightning conductors, and iron wire rigging is coming into general use.

But, over the many vegetable fibres known to be more or less adapted to the purpose of rope-making, preference is given to that of the cultivated hemp plant, the fibres of which possess, in a remarkable degree, the essential qualities of flexibility and tenacity.

Hemp may be several months in its transit from its native fields to the rope-walk, during which time it will have passed through the different operations known by the technical terms of water or dew rotting, scutching and hackling; or, in other words, dissolving, by water, the glutinous matter which binds the fibrous portion to the woody core, thus setting it free; breaking the stalk, and separating it from the fibre; and combing out the hemp to separate the long and superior fibre from the short and indifferent ones, or *tow*, and the more thoroughly to clear it of the woody substance. The tow is again hackled and used for inferior kinds of rope.

The hemp of commerce is put up in bundles of about 200 lbs. each. If good, it will be found to possess a long, thin fibre, smooth and glossy on the surface, and of a yellowish green color; free from "spills," or small pieces of the woody substance; possessing the requisite properties of strength and toughness, and inodorous.

When received by the rope-makers, two different samples are selected from the bale, hackled or combed out to remove the tow and dust, and laid up into ropes 1¾ in. in circumference.

The yarn for two of these ropes is spun from the best hemp found in the bale, and of the fine size called 40s; for the other two it is coarser, of inferior quality, and of the size known as 20s. For one rope of each kind the yarns are tarred. Three lengths of six feet each are cut from the sample ropes, weighed, and sub-

jected to a test strain of 4,200 lbs. for the dry; 3,200 lbs. for the tarred, which they are required to bear. The weight should be from .50 to .60 lbs. per fathom for dry, and from .60 to .70 lbs. for tarred. The hemp should not contain over 20 per cent. of tow and waste.

The highest grade of hemp for cordage is the Riga Rein or Polish hemp of Russia.

Italian hemp is only used in the navy for packing for engines, its cost being more than double that of Russian hemp.

The Native American dressed hemp, easily distinguished by its dark grayish color, is preferred for many purposes, such as for marline, houseline, hambroline, and all cordage spun by hand, the fibre being stronger than that of the Russian hemp.

In rope-making, the fibres of hemp, not averaging more than 3½ feet in length, must necessarily be overlapped among themselves and compressed together so as not to be drawn apart. The required compression is given by twisting, the fibres being continuously drawn out together, from a bundle, in the right quantity to produce the required size of *thread* or *yarn*. Yarns are then combined by twisting, and form a strand; three or four strands, by twisting, form a rope, and three or four ropes, a cable. These successive steps, in each of which the twist is reversed, cause the strain to be more equally diffused among the fibres than it would be if these were laid together in sufficient quantity at once and twisted, and moreover, the alternating directions given to the twist in the several operations, cause the different portions to bind upon themselves, and form a permanently firm bundle. The fibres only once twisted, make but a loose bundle, which, though decidedly stronger than the same quantity made into a hard-twisted rope, is not so durable nor so well adapted to the ordinary purposes of rope. Its actual loss in strength, by twisting, as found by trial, is about one third the full strength of the fibre; its loss in length, from the same cause, being also one third. Rope is made in long buildings called ropewalks, and by machinery too extensive and complicated by far to find a description here.

The general rule is to spin the yarn from right over to left. All rope yarns are, therefore, *right-handed*. The strand, or *ready*, as it is sometimes called, formed by a combination of yarns, becomes *left-handed*. Three of these readies being twisted together, form a *right-handed* rope, known as *plain-laid rope*, Fig. 221, Plate 26. When three such ropes are laid up together, it forms a cable of nine strands, called *cable-laid rope*, Fig. 223, which becomes *left-handed*.

PLATE 26

Fig. 221

Fig. 222

Fig. 223

Fig. 224

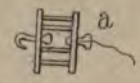


Fig. 225

Fig. 229

Fig. 226

Fig. 227

Fig. 228

Fig. 230

Fig. 231

Fig. 232

ROPE.

In the first steps, if four strands had been used, instead of three, it would have formed what is called *four-stranded or shroud-laid rope*, Fig. 222.

A 3-inch rope having been arbitrarily assumed in the key to the sizing of yarns, the number of yarns of a certain size required to make one strand gives to that size its technical number. These numbers range from 20 to 40 inclusive. This number is also determined by the quantity of yarn required to fill a tube one half an inch in diameter. Thus, if it requires 20 yarns of a certain description to fill the tube, the yarns are termed 20s, &c. The largest size (20s) is used for cables and hawsers. Ropes from 2 to 5 inches are made of 26s. Shrouding, gun-breechings and rope of 2 inches and under, of 28s. Bolt rope, 38s. Houseline, marline, pennant halliards, &c., of 40s.

Rigging is so much exposed to moisture and heat that hemp would soon decay if not protected; before laying up, the yarns must, therefore, be tarred. A large number of reels are set in a frame, so as to be easily unwound, and the ends of the yarns are passed each through its own hole in a guide-plate, over one end of a large trough, which contains tar kept, by means of steam pipes, at the temperature of boiling water. The yarns are all made to pass through guides placed near the bottom of the trough, one at each end, thence up through rollers at the farther end, by which the excess of tar taken up is pressed out. The quantity of tar absorbed is from 16 to 25 per cent. Tar, though really injurious in its effects upon the hemp fibre, has been found indispensable to its general preservation.

Hemp-Rope, when *plain-laid*, Fig. 221, and not tarred in the laying up (in which case it is termed *White-rope*), is the strongest of this species of cordage.

White-rope, not to be confounded with Manilla, is used on board ship for lead and log-lines, ensign and pennant halliards, &c.

The tarred plain-laid ranks next in point of strength, and is in more general use than any other. The lighter kinds of standing rigging, much of the running rigging, all block straps, and many purchase falls are made of this kind of rope.

Cable-laid or Hawser-laid Rope, Fig. 223, is left-handed rope of nine strands, and is so made to render it impervious to water, but the additional twist necessary to lay it up seems to detract from the strength of the fibre, the strength of plain-laid being to that of cable-laid as 8.7 to 6; besides this, it stretches considerably under strain.

ROPE.

Back-handed Rope. In making the plain-laid, it was said that the readies were left-handed, the yarns and the rope itself being right-handed. If, instead of this, the ready is given the same twist the yarn has (right-handed), then, when brought together and laid up, the rope must come left-handed. This is called *left-handed* or *back-handed* rope. It is more pliable than the plain-laid, less liable to *kinks* and *grinds* when new, and is allowed, though now seldom used, in the navy for reeving off braces.

Shroud-laid Rope, Fig. 222, Plate 26, is formed, as stated, by adding another strand to the plain-laid rope. But the four spirals of strands leave a hollow in the centre, which, if unfilled, would, on the application of strain, permit the strands to sink in, giving the rope a rough and *gouty* appearance, and detracting greatly from its strength by an unequal distribution of strain. The four strands are, therefore, laid up around *a heart*, a small rope, made soft and elastic, and about one third the size of the strands.

Four-stranded rope was generally supposed to be weaker than the plain-laid. Experiments show that when under 5 inches, it is weaker than three-stranded of the same size; but from 5 to 8 inches, the difference in strength of the two kinds is trifling, while all above 8 inches is considered to be equal to plain-laid when the rope is well made. Shrouds, stays, and back-stays, and frequently the laniards of lower rigging, are of this rope.

Tapered Rope is used where much strain is brought on only one end. That part which bears the strain is full-sized, tapering off to the hauling part, which is light and pliable. Fore and main tacks and sheets are made of tapered rope.

Twice-laid Rope is made from second-hand yarns. For certain reasons, good rope may be unlaid, yarns added or subtracted and laid up afresh. This rope may be readily known by the different shades of color of the yarns, but it is often difficult to determine, by mere inspection, whether it is relaid from what was good rope, and, consequently, still good, or made up from junk or condemned rigging, and worthless. Twice-laid rope is only met with on board ship when necessity has compelled its purchase on foreign stations.

Manilla Rope seems to be better adapted to certain purposes on board ship than hemp, being more pliable, buoyant, causing less friction, and not so easily affected by moisture. It is used for hawsers and tow-lines, and is much preferred for running rigging. Actual experiment has decided its superiority over hemp for gun-tackle falls, and it is always selected for heavy purchase falls. The process through which it passes in manu-

facture is similar to that of hemp. Before being worked up, the material is sprinkled with whale oil, and the yarns are not soaked in tar, as a general rule; though, occasionally, when making large hawser or sheet cables, the outside yarns of each one of the nine strands are passed through the tar-trough.

The *Whale-lines* used on board our whalers are made of manilla, carefully selected for the purpose. The lines are $1\frac{2}{16}$ to $1\frac{14}{16}$ inches in circumference; they are buoyant and very strong, the test strain being 6,000 lbs.

Hide-Rope is made of yarns or strings cut by machinery from green hides. It is used for topsail tyes, wheel ropes, bridles for the jibs, &c.; also for tailing on to such ropes as are exposed to much chafing in one particular part, such as yard ropes, topsail and topgallant sheets, boat falls, &c. Hide-rope requires care to keep it in good order; and it should not be exposed to the weather unnecessarily. That which is in actual use should be greased the "first and third Fridays" of the month, when spars are scraped, using for the rigging two parts of grease and one part of tar, and for the wheel-ropes, neat's-foot oil.

When hide-rope is to be stowed away (spare wheel-ropes for example), it should be well oiled, and headed up in a beef-barrel to preserve it from rats and mice.

The Book of Allowances, U. S. N., says:

"Hide-rope is never to be greased, but a lick of thin tar (Swedish preferred) is to be given to it at once, and this is to be repeated at the end of every five or six months, or as often as may be necessary to secure it from the weather. Avoid serving the splices of hide-rope."

Bolt-Rope is the name applied to rope used for roping sails. It is made of the best hemp and finest yarns, and is considered the most superior kind of cordage.

Wire Ropes were originally used for mining purposes in the Hartz Mountains, about the year 1831, and in '38 began to be used in England. The superiority to hempen ropes was said to consist in their much greater strength, and greater durability when subjected to the peculiar causes of destruction common to mines, as running through muddy water, frequent rubbing on rough surfaces, and constant wear on pulleys.

In their less weight, bulk, cost, and greater durability, they were found to possess very decided advantages for the standing rigging of ships, over ropes of hemp, and they were soon adopted for this purpose on board of many of the English men-of-war and merchantmen, till, in 1857, about three fourths of all the ships

rigged at Liverpool were provided with standing rigging of this character.

Besides the great advantage that wire rigging possesses of not being affected by the heat and sparks from the smokestack, its durability is at least three or four times that of common rope, and, when once completely *set*, does not require further pulling up.

Wire rope may be used for strapping blocks, and will be found neat and serviceable.

In the United States, wire rope of a very superior quality has been manufactured. Cables of 10 inches in diameter containing seven strands, each strand having 520 wires, were manufactured at an establishment in New Jersey, for the suspension bridge at Niagara.

Wire rigging of a very superior quality is now made at the ropewalk in the navy yard, Boston. It is six-stranded, right-hand rope, and has a hemp heart. The machinery for the manufacture of this rope occupies very little space, compared to the long ropewalks used for making hemp cordage. The best charcoal wire is used. Each wire is reeled on a bobbin or drum, seven (or the number required) of which are placed on spindles on a disk revolving in a horizontal plane. The ends are led up through a fair leader above the centre of the disk, and the machinery put in motion. The disk, revolving, lays the wires up into a strand or ready, while each drum revolves on its own axis in an opposite direction, to counteract the twist which would otherwise be given the wire.

As the strand is formed, it passes over rollers, and is reeled up on another bobbin as fast as made. The bobbins containing the strands are then placed on the disk, the machinery set in motion, and the rope laid up for any length up to a mile.

Wire rope for general use in the navy is made from one quarter to seven inches, inclusive, in circumference, those being the maximum and minimum sizes likely to be needed.

All wire ropes have nineteen wires to a strand, and six strands to a rope.

Each strand has a hemp heart, and the rope itself has a heart of the same material; this adds greatly to its pliability.

When first introduced, it was thought that great difficulty would be found in manipulating wire rigging, but our best riggers cut, fit, and splice it as readily as they do hemp rigging.

ROPE.

In the following table will be found the relative strength of the several kinds of rope :*

HEMP.		IRON.		STEEL.		EQUIVALENT STRENGTH.	
Circumference in inches.	Lbs. weight per fathom.	Circumference in inches.	Lbs. weight per fathom.	Circumference in inches.	Lbs. weight per fathom.	Working load, cwt.	Breaking strain, tons.
2¾	2	1	1	—	—	6	2
		1½	1½	1	1	9	3
3¾	4	1⅝	2	—	—	12	4
		1¾	2½	1½	1½	15	5
4½	5	1⅞	3	—	—	18	6
		2	3½	1⅝	2	21	7
5½	7	2⅛	4	1¾	2½	24	8
		2¼	4½	—	—	27	9
6	9	2⅜	5	1⅞	3	30	10
		2½	5½	—	—	33	11
6½	10	2⅝	6	2	3½	36	12
		2¾	6½	2⅛	4	39	13
7	12	2⅞	7	2¼	4½	42	14
		3	7½	—	—	45	15
7½	14	3⅛	8	2⅜	5	48	16
		3¼	8½	—	—	51	17
8	16	3⅜	9	2½	5½	54	18
		3½	10	2⅝	6	60	20
8½	18	3⅝	11	2¾	6½	66	22
		3¾	12	—	—	72	24
9½	22	3⅞	13	3¼	8	78	26
10	26	4	14	—	—	84	28
		4¼	15	3⅜	9	90	30
11	30	4⅜	16	—	—	96	32
		4½	17	3½	10	108	36
12	34	4⅝	20	3¾	12	120	40

Cotton is a poor substitute for hemp, in rope-making, lacking its strength and durability. It retains moisture when once wet, and is liable to soon rot.

Flax is used sometimes for deep-sea sounding-lines when great depths are required. Sail-twine is made of it and of cotton.

The size of a rope is denoted by its circumference, and the length is measured by the fathom. The cordage allowed in the equipment of a man-of-war ranges from 1¼ (15-thread) to 10 inches inclusive.

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* "Tarred hemp ropes of 3½ and 3 inches, made at the navy ropewalk, Charlestown, Mass., on a trial, required, respectively, a strain of 14,026¼ and 10,725 pounds to break them, and therefore their utmost strength per square inch was 15,000 and 14,975 pounds, considerably more than double of what is ordinarily assigned as the utmost strength of good hemp rope. These ropes were not made expressly for the trial."—*Book of Allowances.*

ROPE.

Small Stuff is the general term applied to small rope, and is particularized by the number of threads or yarns it contains; thus, we have 24, 21, 18, 15, and 12 thread *ratline stuff*; 9, 6, and 4 thread *seizing stuff*.

Hambroline is a finer description of stuff and used for seizings.

Roundline, or *rounding*, as it is sometimes called, is made of three fine, back, or left-handed yarns, so that the stuff itself is right-handed. It is smooth and neat in appearance, and is used for service, seizings, &c.

Spun-Yarn is made of "*long tow*," as it is termed, or the tow of the first hackling hackled again, laid up loosely, left-handed; and to keep it from opening, is well tarred and rubbed down. It is known as four, three, and two-yarn spun-yarn. Spun-yarn is always in great demand on board ship, being used for seizings, service, and a great variety of purposes.

Houseline is of three threads, and resembles Roundline, though of a different lay.

Marline is of two threads. Both of these are made of finer dressed hemp, and have altogether a cleaner, neater, and smoother appearance than spun-yarn. They also are used for seizings and service.

Houseline and Marline, are laid up from right-handed yarns, and consequently are left-handed.

Ratline Stuff is measured by the fathom, but seizing stuff, hambroline, houseline, marline, and spun-yarn, by the pound.

Nettles, used for hammock clews, and where very neat stops are required, are made by laying up two or three yarns in a taut twist with the thumb and fingers, and then rubbing it down smooth.

Foxes, used for temporary seizings, making mats, sennit, gaskets, reefing beckets, boat grips, bending studding sails, &c., are made of two or more yarns, as required, laid up by twisting by hand, and then well rubbed down with a piece of tarred parcelling.

A Spanish Fox is a single yarn twisted up tightly in a direction contrary to its natural lay—that is, left-handed, and rubbed smooth. It makes a neat seizing and is used for the end seizings of light standing rigging, and for small seizings generally.

For signal halliards, distance lines for flags, yoke ropes, &c., yarns of untarred hemp are plaited by machinery; this is to *avoid the kinking* so common to new rope of the ordinary kind.

ROPE.

Junk is supplied for the purpose of working up into various uses—such as for swabs, spun-yarn, nettle-stuff, lacings, seizings, earings, gaskets, &c.—of all of which the supply, in proper kind, is generally inadequate. Good junk is got out of such material as condemned cables—they having been necessarily made of the best stuff, and condemned before being much injured. Old messengers, old rigging, &c., &c., make bad junk, not being condemned generally until much worn.

Of the worst junk, swabs and spun-yarn should be made; of the best, nettle and seizing-stuff, lacings, earings, &c. The seizing-stuff is intended for blocks, ratlines, &c.; the nettle-stuff for making mats, as well as lacings and earings for studding-sails, boats' sails, &c., and the spun-yarn for fitting and refitting. A surplus stock of all these ought constantly to be at hand, in store, for the purpose of refitting or replacing anything that may happen to be carried away, without loss of time. In order to effect this, the watch on deck, or part of them, ought to be constantly at work about the junk, when circumstances permit, drawing, knotting, and balling off yarns, and assisting the ropemaker in laying up the above-mentioned small stuff, either till the junk is exhausted, or till there is an ample stock on hand.

Large junk, such as lengths of cables, should be unlaid before being put below, that it may admit of being snugly stowed.

Shakings are odds and ends of yarns and small ropes such as are found in the sweepings of the deck after work. They are collected, put in a bag kept for the purpose, and at certain times served out to the watch to be picked into *Oakum*, a good supply of which should always be on hand for any calking that may be required, for stuffing jackasses, boat's fenders, &c.

Use of the Ropemaker's Winch, Fig. 224, Plate 26. A ship's winch, which will make very fair 2-inch rope, is about 15 inches in diameter. In the frame, which is double, are placed five hooks —the three upper ones for general use, the fourth for four-stranded rope, and the centre one for hardening up large rope after it has been laid up by the upper ones (the latter not being sufficiently strong for the purpose). The shanks of the hooks, between the two parts of the frame, are inserted in cogged barrels, which are turned by the wheel, one revolution of which gives nine to the hooks—any one of which can be thrown out of gear by hauling it back close to the after part of the frame.

A *loper* is a swivel hook, Fig. 224 (a), which, by revolving freely, allows the strands to twine up together, by the twist put in them as the top is withdrawn.

ROPE.

The *top*, Fig. 224 (b), is a conical piece of wood, scored on the outside for the reception of the strands. Its use is to keep the strands separate between it and the winch, and to regulate the amount of twist in the rope behind it, by being moved along either slowly or rapidly. When four-stranded rope is required, a hole is bored through the centre, as a lead for the heart.

A length of junk being brought on deck, you proceed to unlay it by attaching the strands to separate hooks, and the loper to the other end—one hand holding back on it, and then heaving back—two hands following the rope down to separate the ends.

Spun-Yarn is made by hooking all the yarns that compose it (according to the size required) upon one hook. You then heave round, the reverse way to the lay of the yarns (which in ordinary rope are all right-handed) until there is plenty of back turn in them, holding on the ends by hand; then rub down and make it up.

In rubbing down, a boy puts the end of a strand over his shoulder, and walks away with it, another hand holding on the rubber (which is the end of the strand doubled up loose) round the stuff they are laying up.

As many lengths of spun-yarn can, of course, be made at once as there are hooks on the winch.

Nettle-Stuff. Hitch the yarns to separate hooks; let a couple of hands then take hold of them, and commencing close to the winch, walk back while it is hove round the reverse way; the yarns are thus hove up the contrary way to what they were originally, to soften them; for when drawn out of rope, they are usually hard and angular; and would not lie square, or bear an equal strain, if laid up in that condition. When thus relaid, the ends are knotted together, the loper hooked on—one hand holding on to it, the top put in, the winch hove round the same way as at first, and the top moved along towards the winch. When up to it, the top is taken out, the yarns unhooked, and hitched to a single hook, then the winch hove round the opposite way to what you have just been heaving it, to harden the stuff up; rub down and make up.

Thus, the yarn will be left-handed, and the nettle-stuff right-handed; for, though the winch is hove round the same way with both, the twist in the yarns causes them to unite abaft the top with the lay of contrary denomination, and the revolutions of the loper prevent the turn coming out again.

Six (or nine) Thread Stuff. Put two (or three) yarns on three separate hooks; hold on the end by hand, keeping each of the *three lengths* separate, and heave round a reverse turn, as with

spun-yarn. When sufficiently hove up, knot the ends together, hook on the loper, put in the top, and proceed as with nettle-stuff.

Hammock Lashings are made of three strands of three or four yarn nettle-stuff, left-handed.

General Remarks on Rope.* The strength of a rope-yarn of medium size is equal to 100 lbs., but the measure of strength of a given rope is not, as might naturally be supposed, 100 lbs. multiplied by the number of yarns contained in the rope. The twist given to the yarn, after certain limits, diminishes its strength, as already stated, and with the best machinery it is scarcely possible that each yarn of the rope should bear its proper proportion of strain. The difference in the average strength of a yarn differs with the size of the rope. Thus, in a 12-inch rope, the average strength of each yarn is equal to 76 lbs., whereas, in a rope of half an inch, it is 104 lbs.

Experiment has shown that by applying a constant, or even frequent, strain equal to half its strength, the rope will eventually break. This seems to be particularly the case with cable-laid rope, which is the weakest of all.

It has been ascertained that a good selvagee, carefully made with the same number and description of yarns, as the common three-stranded plain-laid rope, possesses about the same degree of strength.

It has been shown by experiment, that where a span is so placed as to form an angle less than 30 degrees, the strength of the two parts of the rope or chain of which it is composed, is less than the strength which one such part would have if placed in a direct line with the strain.

Right-handed ropes are coiled down *with the sun*, or in the direction pursued by the hands of a watch; the left-handed ropes, against the sun. An exception to this rule is in the hemp cables and hawsers, which are left-handed and are coiled away in the tiers with the sun.

In taking out new rigging from a coil, the end should be passed through the coil and coiled down against its lay to get the turns out.

* The utmost strength of good hemp rope is 6,400 lbs. to the square inch. One fifth the square of the circumference will express, in *tons*, the weight it will bear before breaking. In practice, however, it should not be subjected to more than half this strain. It stretches from one seventh to one fifth, and its *diameter* is diminished from one seventh to one fourth, before breaking. The weight, in pounds, of a fathom of tarred hemp rope, may be ascertained, nearly, by multiplying the square of the circumference by .234.—*Book of Allowances.*

ROPE.

Rope contracts very considerably by wetting it. Advantage may be, and often is, taken of this, by wetting lashings, which are required to be very taut and solid, and are not permanent, as the lashing of a garland on a lower mast for taking it in or getting it out. For the same reason in rainy weather, braces, halliards, sheets, clew-lines, and other rigging requiring it, should be slacked up to save an unnecessary strain on the rope, and avoid the risk of springing a yard or carrying something away.

Should a gang of new rigging be set up taut and then exposed to a cold rain, the downward pressure of the masts would be enormous, and likely to cause permanent injury to the ship.

Standing rigging is protected from the weather by covering it with a coating of blacking made of tar, whiskey, lamp-black, litharge and salt water.

Running rigging has nothing to protect it from the effects of the weather, excepting, in hemp, the tar taken up in the process of manufacture, but after being wet the air should be allowed to circulate through it freely. Rope should never be stowed away until thoroughly dry.

Running rigging, when not in actual use, should be kept neatly coiled down near the pin to which it belays, taking care always to capsize the coil that the running part may be on top, so that it may run clear. In port, during good weather, the rigging may be coiled down in flemish coils, that is, perfectly flat, as soon as the decks are dry enough in the morning, and left so until the decks are cleared up at seven bells in the afternoon, when the ends should be run out, the rope coiled down snugly and triced up in readiness for washing decks in the morning.

When scrubbing clothes or hammocks, soap at times unavoidably gets on the rigging: it should be carefully washed off before the decks are dry.

At sea, under sail, an officer of the deck should *never under any circumstances* allow such running rigging as may be required, to be triced up or covered over, but *keep it all times ready for running* in case of a sudden and unlooked-for emergency. This applies particularly to the morning-watch when scrubbing clothes or holy-stoning decks.

One rope may be rove by another by putting the two ends together, and *worming* three yarns or pieces of spun-yarn in the lay for three or four inches on each side, and clove-hitching the ends around the rope, or opening the strands and laying them in. This is always done when reeving new braces by old ones, and with running rigging generally.

ROPE.

Rumbowline is the name sometimes applied to coarse, soft rope, made from outside yarns, to be used for temporary lashings, &c.

Rogue's Yarn is a single untarred thread sometimes placed in the centre of the rope, or in the centre of each strand, denoting government manufacture.

The Book of Allowances says, "Avoid covering hemp rope with leather, especially green hide, unless good and well-tarred parcelling be interposed."

Practical Rule for ascertaining the Strength of Rope. The square of half the circumference gives the breaking strain of the weakest plain-laid rope in tons, and is therefore a safe rule.

Thus, by the table, the breaking strain of a 6-inch rope is 10 tons, and by the rule $(\frac{6}{2})^2=9$ tons.

The breaking strain of a 10-inch rope is, by the table, 28 tons, and by the rule $(\frac{10}{2})^2=25$ tons.

No cordage should be subjected to a strain above one third of its estimated strength.

For ascertaining the Weight of Rope. Three-strand, plain-laid, 25-thread yarn, tarred. Multiply the square of the circumference by the length in fathoms, and divide by 4.24 for the weight in lbs.

Ex. 2-inch rope, 113 fathoms. $\frac{2^2\times 113}{4.24}=106$ lbs.—actual weight, 105 lbs.

The divisor for hempen cables is 4.79.

A Practical Rule for determining the relative Strength of Chain and Rope. Consider the proportionate strength of chain and rope to be ten to one—using the diameter of the chain and the circumference of the rope. Half-inch chain may, therefore, replace five-inch rope.

The absolute strength of chain, at the *breaking point* may be found by dividing the square of the diameter in eighths, by 2.4 for round link crane chain, and by 2.7 for chain cable.

The superiority of hempen cable as compared with the chain, in the important and valuable property of elasticity, does not exist to any great extent in the substance of the hemp. Repeated experiments have proved that a fibre of hemp will extend, by a moderate strain, about 1-100th of its length, and contract again when the strain is removed. It therefore appears evident that the whole amount of elasticity, or nearly so, which hemp rope possesses, is derived from the degree of twist imparted to it in the process of manufacture.

ROPE.

The following is a list of some of the particular names of ropes:

Back rope,	Drag rope,	Heel rope,	Slew rope,
Bell "	Draw "	Jaw "	Slip "
Bolt "	Entering "	Leach "	Train "
Breast "	Foot "	Limber "	Tiller "
Bucket "	Gab "	Man "	Top "
Buoy "	Gob "	Mast "	Tow "
Bull "	Grab "	Parrell "	Wheel "
Clew "	Guess "	Ring "	Yard "
Crown "	Guy "	Rudder "	Yoke "
Crotch "	Head "	Ridge "	
Crab "	Hook "	Rolling "	

CHAPTER V.

BLOCKS, ETC.

Blocks are well-known mechanical contrivances, possessing the properties and powers of pulleys. They are generally made by machinery, of ash, and are, what are called, *made* or *morticed*.

The made block, Fig. 225, Plate 26, consists of four principal parts, as follows:—The *shell* or outside, consisting of two or more pieces pinned together; the *sheave* or wheel (b), over which the rope passes; the *pin* or axle (a), on which the sheave turns, and the strap, either rope or iron, which encircles the whole, and by which it is confined to its particular place.

The sheave may be of metal or of lignum-vitæ; if the latter, it is *bouched* (c), in all blocks except those used for the gun tackles. In the patent blocks the bouching contains *friction rollers*.

In the common block the bouching is counter-sunk, and made of a composition of 100 parts of copper and 16 of tin. The sheaves of blocks used for gun tackles are not allowed to be bouched, and the pins are made of hardened copper. The pin of the common block is made of iron.

Morticed blocks, Fig. 226, Plate 26, are made from a single piece of wood, morticed out to receive the sheave.

Blocks are single, double, treble or threefold, and fourfold, according to the number of sheaves contained within the shell; are either single or double *scored*, and are measured by their length—that is, the length of the shell.

The scores are the notches cut at the ends of the shell to admit the strap.

The sizes of blocks used in the navy range from 4 inches to 22 inches inclusive, as follows:—4-inch, 5-inch, 6, 7, 8, 9, 10, 11, 12, 14, 16, 18, 20, and 22, single and double of each size.

The only treble blocks used are for the cat and jeer purchases.

Not included in the above are viol blocks, large blocks used for warping, etc.

BLOCKS.

Quarter blocks, clew garnet blocks, top blocks, tye blocks, cat blocks, blocks for boats' falls, and some others, are iron-strapped. Brace blocks, fly blocks and head halliard blocks have friction rollers.

Under the general name of blocks may be included those without sheaves, to receive the ends of stays and shrouds, as hearts, dead-eyes and bull's-eyes, which are measured by the diameter; and for various other purposes, as *trucks* to go on the end of the skysail pole, *euphroes* for awnings, *cleats* or *cavils* for belaying large ropes, wooden belaying pin (now seldom used), *toggles*, wooden *thimbles*, *travellers*, etc., etc.

Blocks take their names from the purposes to which they are applied, or from some peculiarity of form, the following being the principal ones in common use :—

Bee-Blocks, or simply, BEES, are thick pieces of oak bolted to the sides of the bowsprit, having heavy metal sheaves in them for the fore-topmast and fore-topmast spring stays to reeve through.

Cat-Block, a large, double or three-fold block, iron-strapped and composition sheaves. It has a large hook connected with the strap by a link, to admit play. It is used to raise the anchor to the cathead.

Cheek-Blocks are made of a half-shell, and bolt against a mast or spar, which acts as the other *cheek* or half of shell. The chief bolt serves as a pin for the sheave to turn on. Used on gaffs for brails, etc.

Chunk-Block. A strongly-made block with a thick metal sheave, having a large *swallow* or opening, in proportion to its length.

Clump-Blocks are short and thick, with metal sheaves, as the fore and main tack and sheet blocks.

Clew-garnet Blocks are single, iron-bound, and bolt or shackle to the iron bands on the quarters of the fore and main yard. They hang under the yard and receive the clew-garnets, by which the courses are hauled up. The name also applies to the blocks which hook in the clews of the sail.

Clew-line Blocks are those which are attached to the clews of the topsails for the clew-lines. Formerly, the name applied only to the block on the yard, now called QUARTER-BLOCK.

Dasher-Block is the small block sometime strapped to the extremity of the spanker-gaff, for reeving the ensign halliards.

BLOCKS.

Euphroe. A long piece of wood having a number of holes in it, through which the *crow-foot* for the awnings is rove. It has a score around it for a strap, and is strapped with a thimble for bending the crow-foot halliards.

Fiddle-Blocks, Fig. 227, Plate 26, are made with a long shell so as to have one sheave over the other, the lower being smaller. Used for top-burtons and sometimes for yard tackles.

Fly-Block is the upper block of the topsail halliards. It is double, has a rope-strap, and sister hooks and thimble for hooking to the topsail tye.

Gin-Blocks, Fig. 228, Plate 26, are large composition sheaves which turn in a metal framework. Used principally for topsail tyes, and hook to iron bands, made to fit snugly over the topmast tressle-trees. The name is also applied to the small metal blocks used aloft for various purposes, such as for topgallant and royal braces, topgallant buntlines, etc.

Girt-line Blocks are single, through which girtlines, or single whips reeve, as the mast-head girtlines, in rigging ship, etc. Sometimes mispronounced *gantlines.*

Hanging-Blocks. The term applied to the blocks depending at the fore-topmast head for the jib and staysail halliards. They are single, iron-bound, with friction rollers, and hook to eye-bolts in the topmast tressle-trees.

Jack-Blocks are large single blocks, used formerly for sending up and down topgallant yards, but long since given up.

Jeer-Blocks are large double or treble blocks for reeving the purchases for sending up and down the lower yards.

Jewel-Blocks are single blocks at the extremities of the topsail, topgallant, and sometimes, though rarely, royal yards, through which the studding-sail halliards reeve. The head of the studding-sail, when set, is hoisted to them.

Main-sheet Block is a double or treble block, strapped to the main-boom of a schooner or sloop, for the main-sheet.

Quarter-Blocks, on the topsail or topgallant yards, are double, and are iron-strapped to the quarters of the yards, to give lead to the sheet of the sail above and clewline of the sail below. On the lower yard they are single, for the topsail sheet alone, and on the royal yard they are single, for the royal clewline alone. Those for the topgallant and royal yards go with sister hooks, that they may be readily detached.

Shoe-blocks, Fig. 229, Plate 26, are made of a single piece of wood, without a strap ; the mortices cut so that the two sheaves

may turn at right angles to each other. They were used for the legs and whips of main buntlines. As it does not answer to lead main buntlines down the main stays, in steamers, shoe-blocks are falling into disuse.

Sister-blocks, Fig. 230, Plate 26, are formed of one solid piece and two sheaves, one above the other; between the sheaves is a score for a middle seizing, and on the sides a score for the shrouds to fit in. They are seized between the two forward shrouds of topmast rigging, and give lead to the topsail lift and topsail reef tackle. Frequently, of late, the reef tackle is given a different lead, in which case but one sheave is seized in.

Secret-blocks, Fig. 231, Plate 26, are so made that the sheave is entirely screened, the rope leading through an orifice in the shell just large enough to admit its free passage, the object being to prevent its fouling by small gear catching in the swallow and choking it. Used for clewlines, which are frequently fouled by reef-points, and for clew-jiggers. The shell of the block, Fig. 231 (a and b), is made of lignum-vitæ, and has an iron half-strap and sister-hooks.

Snatch-blocks are always single and iron-bound, with swivel hooks. The shell at the breech is left open, and the strap at that part fitted with a clamp, so that the bight of a rope may be "*snatched.*"

Telegraph-blocks are pyramidal shaped blocks, with a number of small brass sheaves, used for making telegraphic signals.

Top-blocks, Fig. 232, Plate 26, are large, single, iron-bound blocks, used for sending up and down topmasts. They hook to an eye-bolt in the lower cap, hooking from in, out, so that the *bill* of the hook points outward, and the top pendants reeve through them.

Topgallant-top Block is similar to the above, but smaller. It is used for the topgallant-mast rope, and hooks from *in, out,* to an eye-bolt in the topmast cap.

Tye-blocks are large, single, iron-bound blocks, which bolt or shackle to iron bands on the topsail yard, for the topsail tyes to reeve through.

Viol-blocks are large single blocks, with a swallow large enough to take a small hawser; used, formerly, in heaving up anchors when the "voyal," or large rope, took the place of the present messenger.

In the navy-yards there are fourfold blocks of 30 inches and over, for heavy purchases.

PLATE 27

Fig. 233

Fig. 234

Fig. 235

Fig. 236

Fig. 237

Fig. 238

Fig. 238

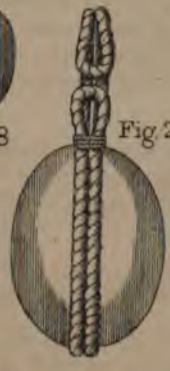


Fig. 239

Fig. 239

Fig. 240

Fig. 240

Fig. 241a

Fig. 241b

Fig. 242

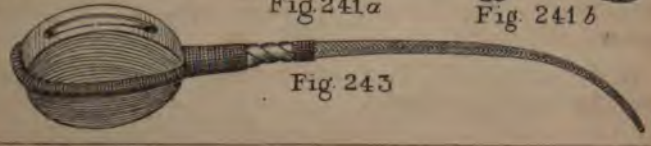


Fig. 243

BLOCKS.

There are some other blocks frequently met with in old ships, but now out of date, such as the D-BLOCK, formed like that letter, and bolted in the chains for the lower lifts; the "long-tackle block," the same as a fiddle-block. MONKEY-BLOCKS, small, iron-strapped, with a swivel hook, to give lead to running rigging. NINEPIN-BLOCKS, named from their shape, and used at the fife-rail. RACK-BLOCKS, a range of small single blocks, to act as fair leaders for running rigging. SHOULDER-BLOCKS, Fig. 233, Plate 27, for topsail sheets and fore tack, having one end square (the shoulder prevents the block from jambing the rope against the yards), and some others. Shoulder-blocks are rarely ever used.

Block-and-block, or two blocks, is the term applied to a tackle when its two blocks are drawn so close together that they cease to operate. The act of drawing the blocks apart is called *fleeting the purchase*, or *overhauling it.*

Blocks should frequently be examined, not only as to strapping, but also by knocking the pin out and inspecting the bouching. The loss of power, and strain on rope, occasioned by a worn bouch, is considerable. The working blocks of tackles (for instance, the fly block of topsail halliards) are always more worn than the lower ones, and, therefore, without waiting until the sheaves shriek and become dumb, the blocks should be shifted and the sheaves transposed. This remark applies also to quarter-davits.

The sheave, on which the hauling part of the rope works, does most duty; for, although it is assumed in mechanics that the strain is equally borne by all parts of a rope in a tackle, practice proves that the hauling part is most worn and strained. If, for example, we have a weight of three cwt. suspended by a luff-tackle, the upper block being fixed, and we hang a weight of one cwt. to the fall, the three cwt. would be balanced, but the fixed block would bear a weight of *four cwt.* And there is something of this kind which calls for greater strength, and frequent alterations in upper blocks.

All blocks which stand horizontally—as lower brace blocks—must be placed with the square end of the pin upwards; as, when the shell shrinks, it is liable to fall out if placed otherwise.

Hanging, Tye, and Quarter-Blocks, undergo great strains when bracing sharp up; if the former are *two blocks*, the weather halliards should be eased up sufficiently.

Cat-Blocks are liable to split, if not unhooked before fishing the anchor. So are Jeer-Blocks, if hove together, as sometimes happens in the excitement of heaving up lower yards.

STRAPPING BLOCKS.

Gun-tackle Blocks are usually strapped with a grommet. One man can fit about eleven of these in a day of nine and a half hours' work; or twelve common, serving his own strap.

Hooks. There is no proportion for hooks, so that while handling heavy weights, unless the hooks be evidently very strong, it is safer to use a shackle or a good mousing. More accidents happen from open hooks than from chain or cordage. Great support may be given a hook by slipping a link or a shackle over the point, Fig. 234, Plate 27.

The hooks of gun-tackle blocks are not allowed to be less than one and a half inches in diameter at the bend for heavy, and one and a quarter for light, broadside guns.

Thimbles are made both perfectly round, and also with the ends nearly joined. Two are sometimes united for the purpose of giving easy play to the adjoining straps or block, as well as a different stand, as in fitting lower, and topsail brace blocks. These are called LOCK-THIMBLES.

STRAPPING BLOCKS.

When not iron-strapped, blocks are fitted with straps of hemp rope, the size and length of which are determined by the purpose for which the block is designed.

Rope for block-straps should be well-stretched, or until it begins to look "long-jawed," that is, the angle of the lay diminished.

The common but rather rough rule for the size is, that the rope for the *strap should be in circumference one third the length of the block*, increasing the size for the straps of heavy purchase blocks; and the old rule requiring the *block to be in length three times the size of the rope* it reeves, brings the rope reeving and the strap about the same size.

Once and a half the round of the block gives a good measure for the common strap, in which the two ends are joined by a short splice; first reeving the ends through the eye of the hook; a seizing of marline, houseline, spun-yarn, hambroline, or larger stuff, according to the size of the block, is then clapped on between the thimble and the block.

The splice should be placed at the breech of the block. After getting a good strain on the strap, the splicing ends may be trimmed off and the strap wormed and served, covered with canvas, leathered, pointed, or grafted.

This latter is done sometimes simply for looks, but covering block-straps at all is objectionable, particularly if they are much

exposed, as they decay more rapidly, and break without warning.

To preserve straps from chafe, however, as in the case of purchase-blocks, they are either served or covered with canvas or leather.

All blocks below twelve inches should be measured for straps with a piece of spun-yarn, around the block, in the *score;* and those above twelve inches, with a piece of small stuff, such as 6, 9, 12, or 15-thread ratline, in the same manner, as the size of the strap increases.

The length of straps depends upon the use they are intended for. Fore and main lift blocks, for instance, take once and a half the round of the block, and once the round of the yard-arm close to the shoulder. Straps for topsail brace-blocks take once and three quarters the round of the block, and are fitted with lock thimbles. Luff-tackle straps are once and three quarters the round of the block, and fitted with strong hooks and thimbles.

Blocks for anchor purchases are double-strapped, and the measure is four times the round of the block; after short splicing the two ends of the strap, the strands are not trimmed off but left sticking out, and a good whipping put on; this prevents the possibility of the splice drawing when under a heavy strain. The splice is always placed at the breech of the block.

A Threefold-Block Strap. Large blocks for heavy work, such as the main purchase of masting, sheers, etc., are strapped with eyes for toggling, as in Fig. 235, Plate 27.

These blocks, being so unwieldly, require a purchase to heave the strap out, and a wedge, or large fid, to fix it in. When this block is strapped on board merchant ships, it is generally done in a vertical direction; reeving a rope through one of the sheave-holes, and making it fast to a ring-bolt, etc.; then hooking a stay tackle (c), Fig. 236, to the two bights of the strap, and setting it taut. A frapping, or temporary seizing, is next put on above the block, and hove well taut by a heaver. A large fid (e) is driven in betwixt the head and the frapping, and a stop of spun-yarn (d—which is too low down in the plate) is clapped on; being rove through the *upper* part of the sheave-hole on each side, and nippered round the strap with a heaver, which keeps it in its place. The fid is then knocked out, the frapping taken off, and the seizing clapped on as before. In men-of-war, when these blocks are strapped, they use a chock, instead of a fid, and a wedge is driven in between the chock and the block. The nipper (d) is taken round both the strap and block, and hove taut with a heaver.

A Grommet-strap. Take four times the round of the block with the rope to be used; this will give, roughly, the required length of strand. A more exact way is to measure with a rope-yarn the *neat* round of the block, and the thimble, the latter placed at the proper distance from the end of the block. With this measure of rope-yarn, lay off on the rope intended for the strap (having previously got it on a stretch) three lengths from the end, marking each one distinctly, with chalk, and cut a little beyond the last mark, to allow for sticking the ends. Unlay the strand, bring the first and second chalk marks together, lay up the grommet and stick the ends. If well made, the grommet will lie flat on the deck. Before forming the grommet, the end must be rove through the eye of the hook. Get it on a stretch; worm, parcel and serve—cover with canvas, leather or point, as required; pass the seizing of marline, spunyarn, or small stuff, according to the size. These seizings are always crossed.

A Common Strap, Fig 237, Plate 27. First, cut the rope once and a half the round of the block, get it on a stretch; worm, parcel and serve as near the end as possible, not to interfere with splicing; then splice the ends together with a short splice, and finish serving snug up to the splice. Stretch it and cut the ends off, or you may serve over the ends. If there are a number of these straps required, it would be best to get the rope on a stretch, and serve off the required number before cutting.

The Single Strap, with Lashing Eyes. Besides being fitted with hook and thimble, the single strap may be fitted with lashing eyes, as in the case of jewel-blocks, blocks on the lower yard-arms for reef-pendants, &c., when they are made as in Fig. 238, Plate 27. Clewgarnet-blocks, when rope-strapped, are also fitted in this way, and the quarter-block on the top-gallant and royal yards, when not iron-strapped.

The Double Strap, Figs. 239 and 240, Plate 27. When strapping large blocks, requiring considerable strength, as in heavy purchases, or when a certain lead is required, the double strap is used, which is simply a single strap of twice the usual length, doubled.

The double strap may be fitted with the thimble only, Fig. 240, with the hook and thimble, or with lashing eyes, Fig. 239.

The leading blocks at the fife-rail are strapped, as in Fig. 240, the thimble playing on a thwartship-rod of iron, otherwise they would not give the fore-and-aft lead.

Quarter-blocks on the lower yards for topsail sheets, are strapped, as in Fig. 239, as they require a thwartship lead. The two eyes of the strap are brought together with a rose-seizing,

the object being not only to strip the yard readily when refitting, but to allow the strap to be tautened up, in the event of stretching, by setting up the seizing afresh.

The Two Single Straps, Fig. 241. It may happen that the double strap will not give the block the desired lead, in which case two single straps are used.

When not iron-strapped, the tye-blocks on the topsail-yards are fitted as in Fig. 241 (a), Plate 27, with lashing eyes. This gives the block a fore-and-aft lead, and the lashing eyes permit the block to be readily stripped off, if required.

The thimble of a truss-strap, on a lower yard, is another example of two single straps.

Strap and Pendant. When a single block is strapped with a pendant, an eye is spliced in the latter much larger than the circumference of the block, and a good seizing is then hove on as in Fig. 242. The lower blocks of yard tackles are fitted in this manner.

Tail-blocks, Fig. 243, Plate 27, are used for single whips, and, generally, whenever a single block is used temporarily. A piece of rope may be spliced around a block, leaving a long tail with the end whipped, or may be unlaid and plaited, as in the figure. Such a block is used in the main rigging for the fore topmast studding-sail tack, and a double one when the boom-brace is used. Sometimes the yarns of the tail are merely opened out and marled down, selvagee fashion.

The double block of a jigger is often strapped with *two* such tails, and called by sailors a *handy billy*. This is very convenient for clapping on anywhere, as when getting the topsail sheets close home, &c.

Cutting and Fitting Block Straps. Knowing how to strap a block, a little practice will enable one to fit a strap for any particular purpose; but, to aid the judgment, a few examples of measurements will be given.

Single Block, with Lashing Eyes. For the length to cut the strap, take twice the round of the block and once the round of the rope, and *marry* the strap once and a half the round of block, and half the round of the rope.

Single Block with Thimble, or Hook and Thimble—such as tack and sheet blocks, a luff tackle, reef tackle, or leading block. Take twice the round of the block, and once the round of the rope. The rounds of the block, thimble and rope, taken once, is the length to marry the strap.

BLOCKS—STRAPS.

Single Block with Long Strap and Lashing Eyes—such as clew garnet blocks, and quarter blocks on topsail, topgallant and royal yards. Take twice the round of the block, twice the round of the rope, and once the round of the yard. After splicing the two eyes, the length of the strap should be once the round of the block and once the round of the yard; and, after the block is seized in, the length of each leg should be one half the round of the yard. The seizing at the block will take up enough to give sufficient drift between the eyes for lashing.

Single Blocks with Straps to fid out, Fig. 244, Plate 28, such as fore and main lift blocks, &c. Take once the round of the yard, once and a half the round of the block, and once and a half the round of the rope; at the distance of once round the yard, block and rope, marry the strap.

A Single Block with Double Scores, for a double strap, as the quarter block on a lower yard, when the two bights lash on top of the yard. Take twice and a half the round of the block, twice the round of the yard and once and a half the round of the rope. At twice the round of the yard and block, and once the round of the rope, marry the strap. That which is taken up by the strap passing around the yard, will give sufficient drift between the eyes for lashing.

Double Blocks with Thimbles, or Hook and Thimble, as luff tackles, &c. Cut the strap twice the round of the block, and marry it once the round of the block, once the thimble, and two thirds the round of the rope.

Brace Blocks for Lower Yards. These are single, thin, double-scored blocks; they are fitted with a double strap, for which take twice the round of the block, twice the round of the thimble, and three times the round of the rope, then allow sufficient to splice.

Gun-Tackle Blocks have grommet straps, one length of rope making three straps. For a double 10-inch block, 3½-inch rope.

	fm.	ft.	in.
3 times the round of 10-inch block	1	1	0
3 " " " 8-inch thimble		2	0
3 " " " 3½-inch rope			10
3 " " " rope at each end for splicing		1	9
Length to cut the rope for 3 straps	1	5	7
And once round the block		2	4
" " " thimble			8
" " " rope			3½
The length to marry the strand		3	3½

BLOCKS—STRAPS.

And this length is to be marked with chalk on the rope before unlaying.

For a single 6-inch block—

	fms.	ft.	in.
3 times round of block		3	10½
3 " " thimble		1	6
3 " " rope			7½
3 " " " at each end for splicing		1	3
Length to cut the rope for three straps	1	1	3
And once round of block		1	3½
" " thimble			6
" " rope			2½
The length to marry the strand		2	0

And so on for any size.

If the grommet is made from four-stranded rope, it will only require three rounds of block, three of thimble, and enough to splice and to marry the strand, once round of block and once of thimble.

To Measure for Seizings of Block Straps. Supposing there are to be seven lower, six riding, and three cross turns—measure where the centre turn comes, which take as the average length of one turn, and allow as much for the six riders as the seven lower turns; this will give fourteen turns; then allow for the three crossing turns and splicing the eye, and there will be sufficient end left to heave the last crossing turn on, making seventeen turns in all.

If there are six lower turns, five riders and three cross turns, allow fifteen turns in all, and so on.

If the block is double strapped, allow five turns for crossing each way.

To put a Seizing on the Strap of a Block. It should be well stretched, a few turns taken out and well rubbed down. Splice an eye in one end, sticking the ends once through, but not cut them off. Pass the eye round the strap, reeve the end through it and round the strap, as many times as required for the lower turns; then pass the end underneath the turns and through its own eye, leaving sufficient bight to heave the turns on; place it square round the strap, lay two strands of the splice down the strap, for the seizing to lay over it, heave the lower turns taut on, haul the slack through the eye, and heave it taut; lay the third strand of the splice on top of the lower turns, and pass the

riding turns over it, put the end between the two last parts of the lower turns, and put the cross turns on; pass one round turn, which will be the centre one, and heave it well taut; then form a half-hitch on each side of the centre turn, which will form a clove hitch with three parts, unlay the ends, make a wall or crown knot, trim off the ends and it is finished.

A double strap should be crossed both ways; first pass two turns between the strap that faces the side of the block, then bring the end out in the same direction as the sheave, and pass three turns there as before.

A rough rule has been given for the proportions of blocks to straps, and to size of rope reeving. The following is more exact:—

For a common thick block, take one third its length for the rope reeving, as a 12-inch common thick block will reeve a 4-inch rope.

For a clump block, take one half its length.

For a thin block, take one fifth its length. For instance, a 12-inch block should reeve a $2\frac{1}{2}$-inch rope.

For a long tackle or fiddle block, take one sixth the length of block.

And for a good guide, take the following

TABLE OF SIZE OF ROPE STRAPPING.

Blocks.	Rope.	Blocks.	Rope.	Blocks.	Rope.	Blocks.	Rope.
5 in.	1 in.	8 in.	$2\frac{1}{2}$ in.	11 in.	$3\frac{1}{2}$ in.	16 in.	5 in.
6	$1\frac{1}{2}$	9	$2\frac{1}{2}$	12	4	18	6
7	2	10	3	14	5	20	7

PLATE 28

Fig. 244

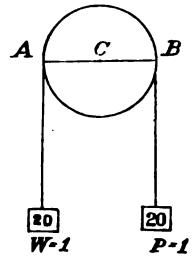


Fig. 245

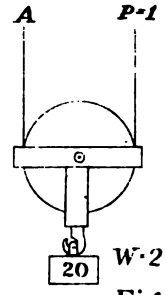


Fig. 246

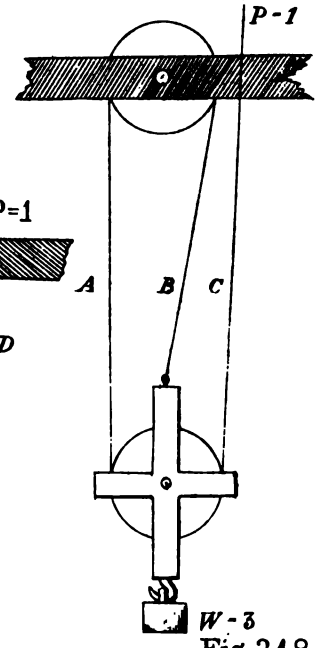


Fig. 248

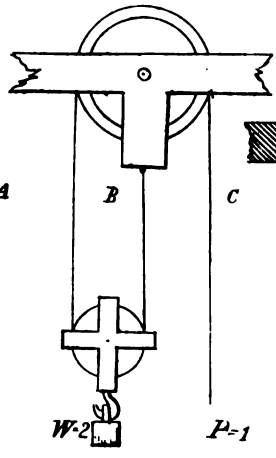


Fig. 247

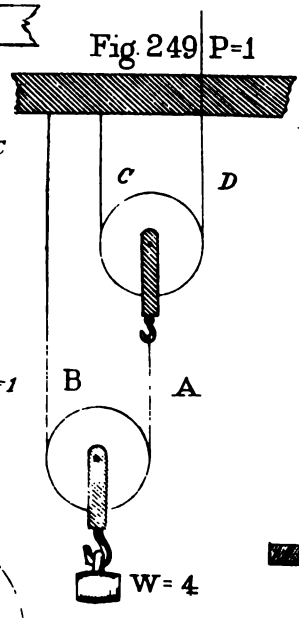


Fig. 249

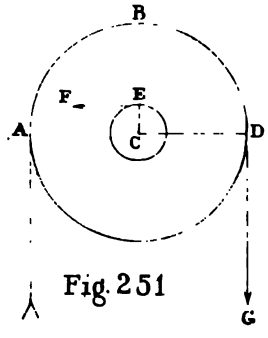


Fig. 251

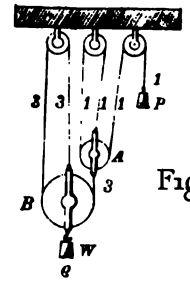


Fig. 250

CHAPTER VI.

TACKLES.

A Tackle is an assemblage of rope and blocks, and is known in mechanics as a system of pulleys. It is used on board ship to raise or move large bodies, support masts or extend sails; is either movable by communicating with a runner, or immovable by being hooked at a fixed point, and is more or less complicated, in proportion to the effects intended to be produced.

The simplest contrivance of this kind is the single whip, or girtline, which consists of a rope rove through a single *stationary block*. By this arrangement, a better lead is given the rope, and the power in many instances can be more conveniently applied; *but no power is gained* by it. This is evident from Fig. 245, Plate 28, where a rope is represented passing over a sheave, whose diameter, A B, may be regarded as the beam of a pair of scales. Then, to counteract the effect of W, the weight, acting on the lever A C, there must be on the equal lever B C, a power equal to the weight; or, 20 lbs. at P will just balance 20 lbs. at W, and nothing is gained. It is evident also, that by increasing the power, P will descend at the same rate that W will ascend.

But this arrangement is extremely convenient and often absolutely necessary, as in hoisting articles from the holds to the upper decks, or from the decks to the masts and yards.

It is quite different, however, when the single block is movable, or attached to the weight to be moved. Let A P, Fig. 246, Plate 28, represent the ends of a rope passing around the sheave of a single block, hooked to a weight of 20 lbs. It is evident that W is sustained by A and P equally, each bearing 10 lbs. Therefore, a person holding the rope at P would only have to hold, by this arrangement, one half of what he would were the rope's end applied directly to the weight—that is, the advantage is doubled; and generally these two principles obtain in all tackles, namely, that *stationary blocks give no gain*, but only serve as a lead to the rope, and *all increase of power is derived from moveable blocks.*

By combining the last two figures in Fig. 247, we have A B, and C, representing a cord passing freely about two sheaves. A sustains half of W, and the strain on C and A being equal, C also sustains half of W; therefore P is equal to half of W. That is

to say, P, the power, is equal to W, the weight, divided by N, the number of parts of rope at the moveable block; or

$P = \frac{W}{N}$: in this case, if $W = 2$, then $P = 1$; and the tackle is in equilibrium.

The arrangement of two single blocks and a fall is commonly known as a gun-tackle purchase, and, as applied in Fig. 247, the power is doubled. But when the blocks are reversed, and applied as in Fig. 248, a still greater advantage is gained. W is sustained by A, B, and C, the three parts of the rope, equally, each part bearing one third; 1 at P will therefore balance 3 at W, or by the equation of equilibrium:

$$P = \frac{W}{N}: \text{ then if } W = 3,\ P \text{ will} = 1.$$

So that the *block having the greatest number of parts* of the fall should be *attached to the weight to be moved, in order to gain the greatest mechanical advantage.*

As, in all purchases, a considerable proportion of power is expended in overcoming friction alone, and as stationary blocks, while they serve to augment friction, yield no mechanical advantage, *there should be as many moveable blocks as possible.*

It has been shown that the greatest advantage is derived from a single block, by attaching it to the weight, when a second block is used, if instead of making it stationary, as in the gun-tackle purchase, it also is made movable, we obtain the utmost advantage from the two—thus, A and B, Fig. 249, sustain the weight, each supporting one half; the half at A is sustained by D and C equally, each taking one half of A, or one quarter of W; hence, 1 at P is equal to 4 at W. If another single block was hooked to D, the advantage would be multiplied eight times, and so on.

The arrangement in this figure is simply a whip and runner, and is the most advantageous way of using blocks. Those ingenious contrivances known as Spanish burtons, owe their efficiency to this principle. Indeed, Fig. 249, is a single Spanish burton inverted, and the two single blocks are applied to the utmost advantage possible, from which we may gather that the most efficient purchase would be a series of moveable pulleys. Hence, the general rule for ascertaining the power necessary to raise a given weight with a tackle, is to *divide the weight to be raised by the number of parts of rope at the moveable block or blocks*, the quotient being the power required to produce an equilibrium, friction not considered.

To ascertain the amount of purchase required to raise a given weight with a given power, divide the weight by the power, and

the quotient will be the number of parts of rope which must be attached to the lower block, or by the formula:

$$P=\frac{W}{N}, \text{ we have } N=\frac{W}{P}.$$

And to ascertain what weight given tackling will raise, the weight a single rope will bear is multiplied by the number of parts at the moving block. These rules will require considerable modification for friction, as will be shown.

Power can only be increased at the expense of time. In the system of pulleys, Fig. 250, Plate 28, if W=9 lbs., required P, when equilibrium takes place.

Here, the three parts marked 3, form a continuous cord, hence they will each sustain the same stretch; and in like manner the four cords marked 1, will each sustain the same stretch. The weight W, with its pulley B, is supported by the three cords, therefore, each cord will carry 3 lbs.; there are therefore 3 lbs. suspended from the pulley A. Now the pulley A, with this weight, is supported by three cords, therefore each cord will carry 1 lb., hence it follows that P must be 1 lb. Again:—

If W ascend 1 foot, the pulley A will ascend 3 feet, because each of the three cords marked 3, will give off 1 foot of cord; in like manner, if the pulley A ascends 3 feet, the weight P must descend 9 feet, because each of the three cords marked 1 will give off 3 feet of cord. Thus it appears that while W ascends 1 foot, P descends 9 feet; hence we have, by the principle of work:—

$$\text{Work of } P=P\times 9;\ \text{work of } W=W\times 1,$$
$$\therefore P\times 9=W;$$
$$\text{and if } W \text{ be 9 lbs., then } P=1 \text{ lb.}$$

Hence, there are many cases on board ship where a great deal of purchase would be a positive disadvantage. Were treble-blocks used for the side tackles of a broadside gun, the gun could be run out more easily than with a double and a single block, but then it would be longer in running out, and there would be an inconvenient accumulation of fall, not considering other disadvantages.

The tackles of a broadside gun furnish a good illustration of the relative advantages of the stationary and movable blocks. The train tackle, as ordinarily hooked, yields the greatest advantage for running the gun in. If, through inadvertence, the blocks were reversed, the effort would be applied to rouse the train bolt out of the deck, rather than to run the gun in. The side tackle is necessarily hooked so as to afford the least mechanical advantage, in order to give a proper lead to the fall.

TACKLES—FRICTION.

In all tackles, when the hauling part, coming from the movable block, is not parallel to the tackle, there is a loss of power, *equal to the tension on the hauling part, multiplied by the cosine of the angle.*

FRICTION.

When a weight hangs by a tackle at rest, all the parts of the fall bear an equal strain, and the weight will be balanced by one at the end of the fall as many times less as there are parts of the rope at the block to which the larger weight is suspended. But directly the fall is hauled upon, this is no longer the case. In consequence of friction, there will not be an equal strain on all parts of the rope; and it becomes necessary in calculating the practical power of the tackle, not (as before) to multiply the force by the number of parts of rope at the moving block, but to find the strain or tension on each part, and add all together.

To do this exactly is extremely difficult, if not impossible; as the different tensions of the parts depend upon so many varying circumstances. Such, for instance, as the flexibility of the rope, which differs according to its size, newness, dryness, and material; the relation of the diameter of the sheaves to that of the pin; the material of these and their condition; upon all which, the amount of resistance caused by friction depends. All we can do is to give some rough rule, which may be to some extent practically useful.

The Sheave and Pin. If A B D, Fig. 251, Plate 28, be the sheave of a block turning from A by B to D, C being the centre of the pin, then the friction will act at the point E in the direction E F, and with a leverage E C. This will have to be overcome by the fall acting along D G, with a leverage C D. The longer, therefore, C D is in proportion to E C, the easier will the resistance by friction be overcome; consequently, the pins being the same, the greater the diameter of the sheave, the easier the block will work.

The same rule applies to the capstan as well as the block. The longer the bar, the more easily will the resistance of the friction on the spindle be overcome.*

* "The loss by friction is less as the bars are longer, or as power is applied at a greater distance from the axis. It is least of all when the pressures are so distributed *round* the capstan as to be reducible to a 'couple.' The case in which the moving pressures upon the capstan are reducible to a couple, manifestly occurs when they are arranged round it in any number of pairs, the two pressures of each pair being equal to one another, acting on opposite sides of the centre, and perpendicular to the same line passing through it. This symmetrical distribution of the pressures about the axis of the capstan is therefore the most favorable to the working of it, as well as to the stability of the shaft which sustains the pressure upon it."—*Mossley's Mechanics.*

PLATE 29

Fig. 252

Fig. 253

Fig. 254

Fig. 255

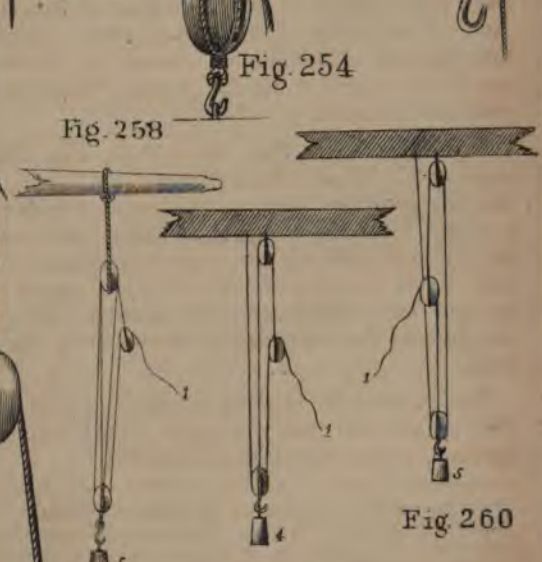


Fig. 258

Fig. 259

Fig. 260

Fig. 256

Fig. 257

TACKLES—FRICTION.

If the rope which passes round the sheave of the block be small, it will be more flexible; a less force will be necessary to "nip" it round the sheave, and there will be less resistance by friction against the inside of the shell of the block.

Perhaps we shall not be far wrong, in ordinary cases, if we estimate one sixth of the original force to be consumed by friction each time the rope passes round a sheave. Thus, supposing the tension or strain on the hauling part be 6, that on the next will be 5, the next 4, the next 3, and so on. So that if the strain on the fall of a two-fold tackle be 6, the tensions or strains on the parts of the rope will be represented by the figures 6, 5, 4, 3, and their sum, 18, will nearly represent the power of the tackle, instead of 24, which it would have been had there been no friction; or about one fourth of the force would have been consumed by it.

Suppose a weight of 24 to be suspended by the above tackle. If the fall would just bear a weight of 6, the four parts would be sufficient to suspend the weight: but if it were required to raise it, we must have a rope at least one third stronger; or equal to sustain a weight of 8. The tensions would be, according to the above rule—8, 6⅔, 5⅓, and 4, and their sum will be 24, which is what we require to lift.

From these considerations, we gather that work is lightened by using *large blocks and small ropes:* the boatswain's rule, that the hauling part of a fall bears double the strain of the standing part, is not far wrong; that as the pin of a block is more worn on one of its sides, it should be frequently turned; and that as sheaves nearest the standing part do least duty, they should be shifted occasionally with the others.

There are about five different purchases in common use, viz:

A Single Whip, Fig. 252, Plate 29, which consists of a single stationary block and fall. By it the power can be more conveniently applied to the weight, but no power is gained. It is therefore, in reality, no purchase at all. The term whip is sometimes applied to tackles, as the *water-whips.*

A Runner, Fig. 253, Plate 29, a single movable block and fall. In this case, the fall is called the runner, and has a thimble spliced in the end, for hooking a purchase to. By it the power is doubled. The main bowline and topsail tyes are instances of runners. Runners, as in the figure, are used for setting up backstays, and generally wherever they can be applied to advantage.

A Gun Tackle Purchase, Fig. 254, Plate 29, is composed of two single blocks, strapped with hook and thimble, the standing

part of the fall bent to the becket, or spliced into the strap of the block from which the fall leads. The advantage derived from this purchase has been given already. Its gain is as 1 to 3.

A Luff Tackle, Fig. 255, Plate 29, consists of a double and single block, each strapped with a hook and thimble, the standing part of fall bent to the becket, or spliced into the strap of the single block. If the double block is hooked to the weight, the power is multiplied four times; if the single block, then but three times. A luff upon luff gives an increase of 16 times, by adding another 64, &c.

A Twofold Purchase, Fig. 256, Plate 29, consists of two double blocks, the standing and hauling part leading from the same block, and *on opposite sides*, so that the block will not cant. The power gained is four or five times, as it may be applied.

A Threefold Purchase consists of two treble blocks, having the fall and standing part leading from the same block, and from opposite sides. Its power is six or seven times.

The foregoing are the principal kinds of purchase in use on board ship; all others are combinations or modifications of these, and take their names from the purpose for which or place where used, the following being those in most general use:

Boom Tackle, or boom-jiggers, used in large ships for rigging in and out the studding-sail booms. In schooners, the tackle which guys the main boom forward, when going large.

Burtons are light tackles. The term *burton* by itself, is generally understood to apply to those which are nearly always kept hooked to the pendants, at the topmast heads, ready for use, and called *top burtons*. They are the same purchase as a luff, but instead of the common double block like a luff, it has a fiddle block, both for neatness and convenience, there being but little room close up under the eyes of the topmast rigging. The falls of these burtons are long enough to permit both the lower block and hauling end to reach the deck, with plenty to spare, while the upper block is hooked to the topmast pendant. These burtons are used chiefly for supporting the lower yards when hoisting out boats, purchasing anchors, &c. In cases of emergency, such as carrying away a topsail yard, they prove very serviceable.

Spanish Burtons are of various styles, and are of frequent use in the merchant service, the following being the principal:

A single Spanish burton, Fig. 257, Plate 29, consists of two single blocks, the standing part spliced in to the strap of the movable block and the bight seized or bent to the hook. This increases the power three times.

PLATE 30

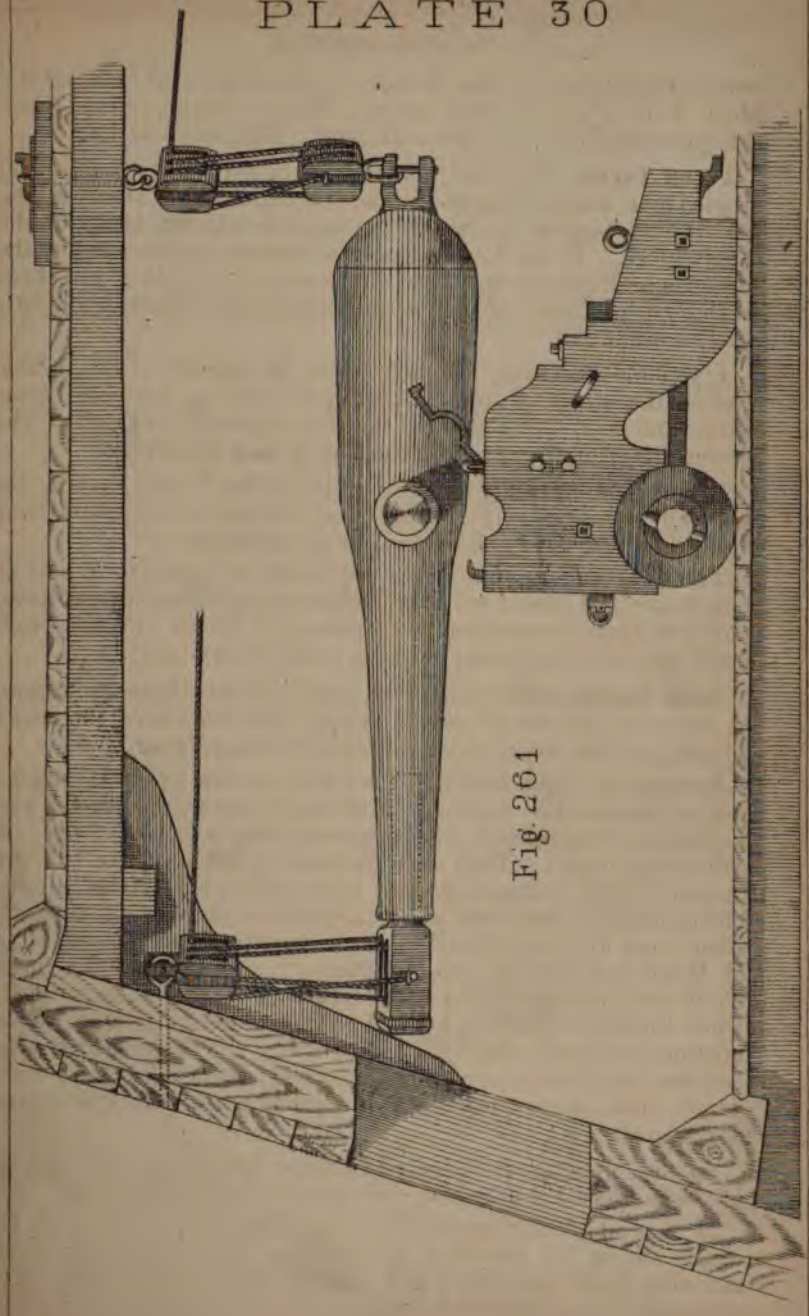


Fig. 261

TACKLES.

The double Spanish burton, Fig. 258, has one double and two single blocks; the standing part spliced in the strap of one single block, then rove through the double or fixed block, and the bight seized to the strap of the lower block, to which the weight to be lifted is hooked. The end is then rove up through the double block, through the lower and lastly through the single block to which the standing part is secured. This purchase gives an increase of five times the power applied.

Other Spanish burtons, Figs. 259, 260, are formed of single blocks, which quadruple and quintuple the power, respectively.

A Deck Tackle is a heavy purchase, of a double and single, or two double blocks. It is used for rousing in chains, and for heavy work generally.

Fish Tackle is a heavy purchase of double and single or two double blocks, used for fishing the anchor; that is for raising the crown to get the inner fluke up to the bill-board after catting.

A Fore-and-aft Tackle is one used to get the awnings on a fore-and-aft stretch. The term is also of general application to any tackle whose use, for the time being, may be in the direction of the length of the ship. In the same way we have *thwartship-tackles.*

The Griolet Purchase, Fig. 261, Plate 30, for dismounting guns on covered decks, is composed of—

A toggle block, made of elm or oak, the outer end or *head* of which is made rather greater in diameter than the inner one, which exactly fits the bore of a 32-pounder. The *head* has two sheaves in it, so as to form the lower block of the *muzzle purchase*, and is bound at the outer end with an iron band.

A double *cascable block* of iron is made either with a shackle, or to fit between the jaws of the cascable, where it is secured by the cascable pin. The iron pins on which the sheaves revolve are formed with eyes, for the convenience of hitching the standing part of the purchase.

Two *iron treble blocks*, one for the upper muzzle and the other for the breech purchase.

The *muzzle purchase block* is so fitted as to be either shackled or toggled to the housing bolt above the port, and the *breech purchase block* has an iron strap terminating above, with an eye by which it is shackled to a bolt passing through the deck above the gun. This bolt has an eye in one end and a screw or key-slit at the other, and when in place, is secured above the deck with a nut or key, between which and the deck a washer of hard wood or iron, of suitable breadth and thickness, is placed.

The hole through which this bolt is put, should be directly above the cascable block when the muzzle of the gun is under the housing bolt, and may be bored at the time the gun is to be dismounted; and stopped afterwards with a plug of wood coated with white lead.

But as it is desirable that every division on the gun deck should be exercised in mounting and dismounting its guns, a hole may be made in the deck above each division, and bouched with a composition screw-tap.

The purchase falls should not be less than three and a half inches in size, and should be made of manilla rope of sufficient length to reeve full, the gun being supposed to be on deck and the upper blocks in place, allowing also sufficient end for splicing in the thimble and hitching the standing part of the purchase when rove.

An iron thimble large enough to hook the double block of a side or train tackle is spliced in to the end of each purchase fall.

Garnet Tackle is the tackle hooked to the garnet in getting guns in on a covered deck. The garnet itself is a single piece of rope or a pendent passed through a hole, bored for the purpose in the spar deck, and has a hook and thimble spliced in one end, and a thimble in the other, or upper end, to which the pendant tackle or garnet tackle hooks.

Girtlines are, generally speaking, single whips. The name applies particularly to those used at the mast-head in getting up tops, rigging, &c., when rigging ship. Hammock Girtlines are simply lines on which to stop scrubbed hammocks for drying. They are fitted in various ways, and formerly had permanent (nettle) stops attached; but now the "long" or harbor clothes-lines are used for the purpose.

Gun Tackle. A double and a single block. Gun-tackle falls are made of Manilla, or such other pliable rope as may be directed from time to time by the Bureau of Ordnance. It is prohibited to blacken them or to diminish their pliability. Three-inch rope will be found large enough for the heaviest, and from $2\frac{1}{4}$ to $2\frac{1}{2}$-inch for the lighter guns.

The rope being well stretched, the falls are cut of sufficient length to allow the full recoil, leaving end enough to hitch round the straps of their double blocks, when hooked to the middle or fighting bolts.

Gun Tackle Purchase. See *ante*, page 77.

Hatch Tackles. These are common luff purchases, and are used generally in the hatches over the spirit room, or fore hold. When the upper block is required to be above the spar deck, it

should not be permitted to hook to the lower stay, but to a long pendant, hooking to the lower cap and stopped out to the stay by a lizard.

Jeers, for sending up and down the lower yards, are variously rove. The plan now is, to have one treble block, with the strap reeving through the pigeon-hole in the top, and secured around the lower cap, and two single blocks on the quarters of the yard.

Jiggers, Fig. 262, Plate 31, are small luffs, having the double block strapped with one or two tails, and are used for a great variety of purposes about decks.

Luff Tackles—Double and single block; already described. Such is a luff tackle; but *rigging luffs*, or simply "*luffs*," used exclusively for setting up rigging, are of two kinds, double and single. The double luffs are like the one in the figure, and are used for setting up the lower stays. The single luffs are two single blocks, or a gun-tackle purchase, and are used for setting up the lower shrouds. The side and train tackles of a gun are similar to Fig. 255, Plate 29.* Thus it appears that while we retain the old names, the tackles themselves have undergone some modification, so that there seems to be a confusion of terms—a single luff being a gun-tackle purchase, while a tackle used for a gun is a double luff. In days gone by, when ships' batteries were lighter than at present, it may have been that their side and train tackles consisted simply of two single blocks; hence the term gun-tackle. And with regard to the luffs, they were formerly composed of the double and single block, but it was found that the lower block was too large, was much in the way, and liable to get split while setting up shrouds; consequently the single block was substituted.

Parbuckle, Fig. 214, Plate 25, is the most primitive style of purchase, and consists of a rope, the bight of which is made secure and the ends passed around the object to be moved. It yields the same advantage as ascribed to the *runner*.

Pendant Tackles are large tackles, composed of a double and single block. They hook to the mast-head pendants, whence their name, and are used for setting up lower rigging, staying the mast, or steadying it under certain emergencies.

Propeller Purchase. This is simply to reeve the rope through the sheaves made for it, and take the end to the capstan.

Port Tackles are those used for tricing up the lower deck ports of a line-of-battle ship, and the upper half ports of a frigate.

* For the tackles of the IX-inch guns, two double blocks are used. Fig. 256.

TACKLES.

A Quarter Tackle is composed of a *long-tackle* or fiddle block strapped with a pendant, a single block and fall. When hoisting out or in water, &c., it is used in connection with the yard-tackle, and hooks to the quarter of the fore or main yard. It has been almost entirely superseded by the stay tackle.

Reef Tackles are for rousing the leeches of the top-sails and courses up to the yard arms for reefing. They are variously fitted, and may be either a luff or a gun-tackle purchase, as will be explained hereafter.

Relieving Tackles are for the purpose of hooking to the tiller, in order to steer the ship in the event of the wheel ropes being shot away in action, or to assist in steering in very heavy weather, when the motions of the rudder are sudden and violent. Double and single block.

Rolling Tackles hook to the quarters of the yards (lower and top-sail) and to the mast, for the purpose of steadying the yards in a heavy sea, when the ship rolls much, and to relieve the strain on the trusses, slings, or parrel.

Rudder Tackles hook to the rudder chains or pendants, to steer the ship in case of accident to the tiller or rudder head.

Runners have already been described.

A Runner and Tackle, Fig. 263, Plate 31, is simply composed of a tackle (double and single block) attached to a runner. They are for aiding in staying the lower masts. The power gained is eight times.

Runners are applied in various ways. In a Port-tackle, Fig. 264, the power is doubled by the runner, which is itself trebled by the tackle, making six as the whole power gained.

By the runner and tackle, Fig. 265, the runner doubles the power and is itself quadrupled by the luff tackle, multiplying the whole power by 8.

Stay Tackles are those which hook to the triatic stay, or a lower stay, and are called respectively, *forestay tackle and main-stay tackle*—used in getting the boats in and out. In provisioning or watering ship, when the yard and stay tackles are used, the stay tackle hooks to a strap around the main stay, or, what is much better, to the eye of a pendant stopped out to the main stay, having its upper end hooked to an eye-bolt in the lower cap, or taken around the cap and hooked to its own part.

Side Tackle for running out and training broadside guns. A double and a single or two double blocks.

PLATE 31

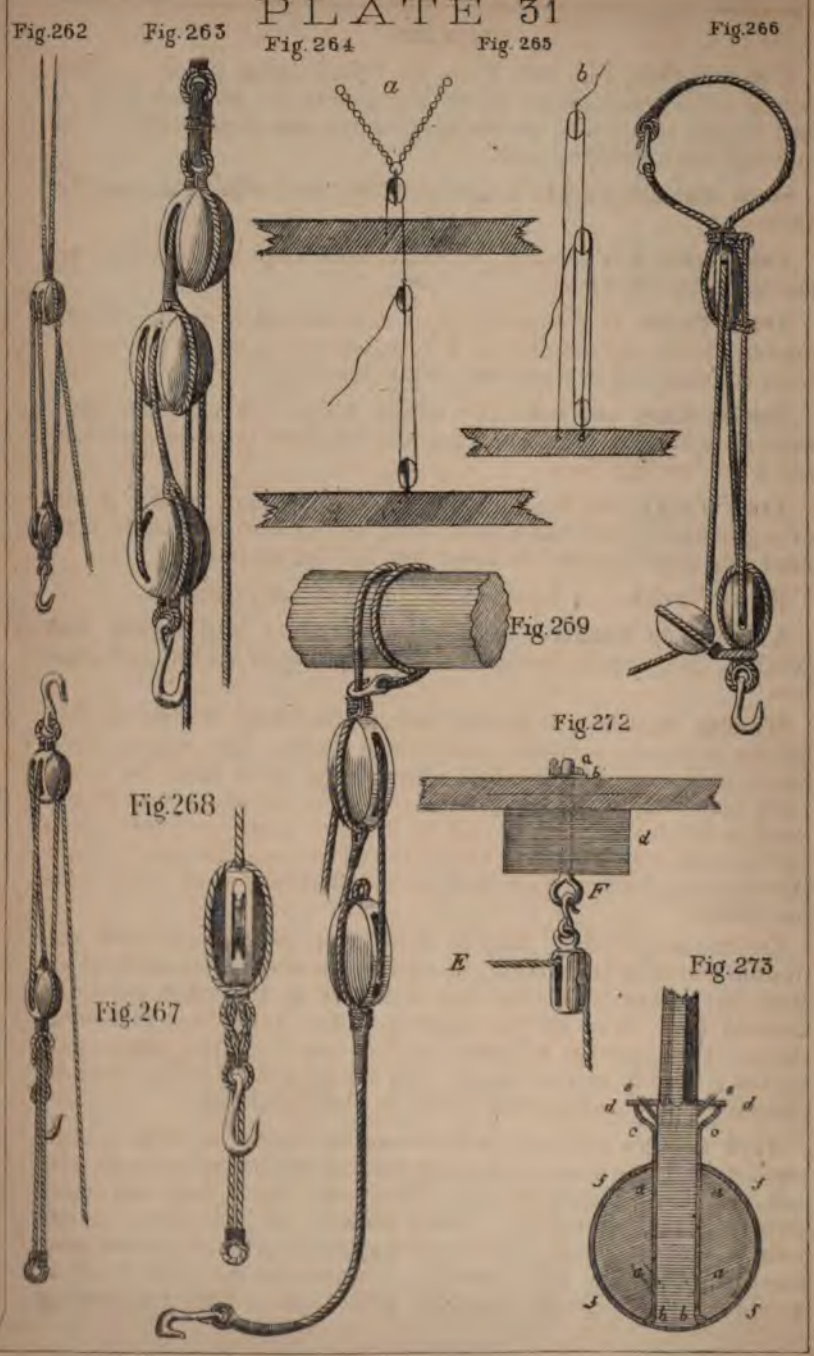


Fig.262
Fig.263
Fig.264
Fig.265
Fig.266
a
b
Fig.269
Fig.272
Fig.268
Fig.267
F
E
Fig.273
d
c
f
g
h

TACKLES.

A Sail Tackle, Fig. 266, Plate 31. The upper block is often double; the small single block below is to act as a fair leader, and the fall to act as a guy in keeping the sail clear of the yards and top when swaying aloft.

Stock and Bill Tackle is a small tackle used when securing the anchor.

Top Tackle is a two-fold purchase, used when sending the topmasts up and down.

Train Tackle is composed of a double and a single or two double blocks for running in a broadside gun, or to prevent it from running out in a sea-way, while loading.

Tricing Lines are generally single whips. Sometimes, however, they are gun-tackle purchases, as the fore topmast studding sail boom tricing lines.

Truss Tackle, for bousing taut the old fashion truss. A luff or a gun-tackle purchase, one block seized into the truss pendant, the other hooked to lower cap, fall led on deck.

Watch Tackle. A common luff purchase or jigger.

A Whip and Runner. Similar to a runner and tackle, but smaller. The main bowline of a large ship is a whip and runner.

Winding Tackle. A double and single block, or two double blocks, formerly a treble and double block. The upper block hooks to the eye of a pendant which hangs down from the lower yard arm. The pendant (generally one of the top pendants are used) is hitched to an eye bolt in the deck near the mast, leads up through a single block at the lower cap, and thence through the thimble of a lizard secured around the lower yard at the burton strap.

Or, the single block may be hooked to the pendant and the double block to the weight, in which case the fall would lead *up* from the lower block through a leader at the mast head (or hooked to a strap on the quarter of the yard), and thence on deck. This relieves a lower yard of much of the strain and makes it simply an out-rigger. By hooking the double block to the weight we increase the power as already shown.

Yard Tackles are large tackles used on the lower yards, in connection with the stay tackles, for getting the boom-boats in and out, purchasing anchors, &c. They are called *fore* and *main yard tackles,* respectively. Yard tackles are not always fitted alike; sometimes the upper is a long tackle or fiddle block, and strapped as in Fig. 269, Plate 31. Sometimes the lower block is strapped as in Figs. 267 and 268, with a strap ready for passing

around any object to be lifted; and very often the upper block alone is fitted as the lower block in the figure, so that the strap is convenient for passing around the yard. This latter is a very good plan.

Water Whips, Fig. 269, Plate 31, are tackles for hoisting in water, when it is brought off by the launch in gang casks.

Besides the foregoing, there are various jiggers, such as *boom jiggers, clew jiggers, bunt jiggers, lift jiggers, &c.;* and whips, such as *yard whips, buntline whips, bunt whips;* tricing lines, as *boom tricing lines, geer tricing lines,* and *tripping lines,* all of which will be explained when used.

General Remarks. One great advantage of a tackle on board ship, which renders its application of constant occurrence when mere power is not wanting, must not be overlooked; as, for example, when hoisting, a jerking is to be avoided, and a steady, gradual strain required, as in staying a mast. Another advantage of a purchase, when fitted to any part of a ship's rigging, is that on *coming up,* when some little must necessarily be given back, only a mere fractional part is lost on the rope itself, as in the laniard of a dead-eye, &c.

To overcome the friction of tackles as much as possible, patent blocks with friction rollers are used, though not where very great strain is anticipated, for fear of crushing the rollers.

The *swallow* of a block should be full large in proportion to the size of the fall; generally one tenth of an inch swallow for every one fourth of an inch in circumference of the rope.

Manilla falls, the fibres of which are hard and smooth, offer less resistance by friction than tarred hemp falls.

The fall of a purchase should have as clear a lead as possible, and the hauling part be in a line parallel to the rest of the purchase.

A score is generally cut in the breech of a block, to admit the standing part of the fall being passed under the strap, so as to splice the end into its own part. When this is done, the splice should be tapered and neatly served over with marline. Neatness requires this in the standing part of the topsail halliards, throat and peak halliards, boats' falls, &c. But in jiggers, luffs, deck and pendant tackles, the standing part is bent to a becket, worked around the strap of the single block, with a sheet or becket bend and the end stopped down. This is to allow the fall to be shifted, end for end, or to be unrove at pleasure.

By reason of friction, the becket in the breech of the standing block may be much less in size than the fall, as the fall there

bears less strain than at the hauling part, and the greater the number of parts of a fall, the greater will this difference be. Notwithstanding this, in heavy purchases, where great weights are to be moved, the standing part is hitched around the neck of the strap, between the block and the thimble; and it is a good precaution, when using any tackle for a great strain, to cast off the standing part from the becket and hitch it around the strap. In large blocks, the standing part is made to go on the side opposite to that from which the fall leads, making it lead fairer, and preventing the tendency of the block to slew in the strap.

Thimbles should be made round, and the ends neatly joined. Hooks should be thick in the bend, and the *bill* or point somewhat flattened and pointing out. When subject to much strain, it should have a good spun yarn mousing, to counteract the tendency to straighten out, or at times to become unhooked.

When a *racking* is to be put on a purchase fall, the hauling part is racked to the part leading from the opposite side of the block.

In rousing in a chain with a deck tackle, the double block is hooked to a selvagee strap around the cable, near the hawse pipes, and when walked in as far as the chain pipes, the block is unhooked and *fleeted* forward, to do which the fall must be *overhauled*.

Sometimes, as in the case of a boat's fall, by the block capsizing, or through carelessness in overhauling, the fall gets a *thoroughfoot* in it—that is, the parts get crossed; before use the thoroughfoot must be taken out.

The following are some of the results of a series of carefully-executed experiments with tackles:—

In a tackle of nine sheaves, 5 upper and 4 lower, the ratio of the power to the weight is as 1 to 4 in hoisting; but only as 1 to 12 in sustaining it in equilibrium. The standing part, in hoisting, experiences the strain of only $\frac{1}{40}$ of the weight in hoisting; but in lowering, it is equal to that which the hauling part experiences in hoisting. The strap of the upper block ought to be 4 times as strong as the fall, or be twice its size. In a tackle of 6 sheaves, the fall experiences an effort equal to $\frac{1}{3}$ the weight when hoisting, and only $\frac{1}{10}$ in a state of equilibrium. The upper strap should be able to sustain an effort once and a third of the weight lifted, or have four times the strength of the fall. A tackle of 4 sheaves requires an effort of $\frac{2}{5}$ the weight in hoisting on the fall, and only $\frac{1}{4}$ to keep it in suspension. The strap should have $3\frac{1}{2}$ times the strength of the fall.

TACKLES.

A tackle of 2 upper and 1 lower sheave requires on the fall $\frac{3}{5}$ of the weight of the resistance in order to raise it, but only $\frac{1}{4}$ to sustain it in its place. In hoisting, the standing part takes a strain of about $\frac{1}{3}$ of the weight suspended, $\frac{1}{4}$ in keeping it suspended, and $\frac{2}{5}$ in lowering the weight. When composed of one upper and one lower sheave, the fall of the tackle requires the exertion of a power equal to about $\frac{5}{9}$ of the weight to move it, and $\frac{4}{8}$ to keep it in equilibrium, so that the strap should be 3 times the strength of the fall, or $1\frac{1}{2}$ times its size.

The Purchase gained by Swigging Off. What is called swigging off—that is, pulling at right angles to a rope, is, at first, a very great power; but it decreases as the rope is pulled out of the straight line. This purchase depends upon the resolution of forces, and its power is as the sine of half the angle formed. A purchase upon this principle may be conveniently applied to several purposes. By it a boat may be hauled up on the beach. At some distance up from the water, drive in a stake, and near the water, in a line with the boat, drive in another. To the upper stake secure the boat's painter, passing it along against the lower one. Now, by swigging off upon the painter midway between the stakes, the boat's crew will pull with an increased power, and if this be insufficient, it may be increased by moving the stakes farther apart.

CHAPTER VII.

MASTS AND YARDS—RUDDER.

Masts are most liable to decay at the heel, partners, and cap; bowsprits at the cap, under the gammoning, and at the heel. Masts are most liable to spring at the partners, tail of bibbs, and hounds; bowsprits at the cap, and on top between the gammoning and cap.

When a spar "buckles," or what is called having the grain upset, and the fibre in different parts takes a sinuous form, it is a sign of much weakness. When the outer fibres are found broken in the form of steps, or what are called Jacob's ladders, the defect seldom admits of repair.

Masts are made of several pieces, united by dowels or coaks, and hoops.

In the United States Navy, the made masts consist of four principal pieces, each of which consists of two or more parts, scarfed together, when a whole piece, of sufficient length, cannot be obtained. These pieces are placed as in Fig. 270, Plate 32. The inner corner of each piece is taken off so as to leave a square hole extending throughout the whole length of the mast, in its axis. This admits of a closer contact of the parts of the mast with each other when the hoops are set up, and does not take from the strength of the spar. This hole is one tenth of the diameter of the mast in size.

The hoops are placed from three to three and a half feet apart from each other, and are from four and one quarter to five inches wide, and from four eighths to five eighths of an inch thick, according to the class of ships the mast is made for. They must, however, be kept clear of the wedges at the partners. The scarfings of the piece must be kept clear of each other (that is, the points of junction in one piece must be as far as possible from those in another piece), and equally distributed in the mast. There is a *chafing batten* on the forward part of the mast, about one fourth the diameter of the mast in width, and one eighth in thickness.

The principal parts of a mast are the *head*, *hounds*, *bibbs*, *neck*, *partners* and *heel*.

MASTS, ETC.

The head, A B, extends from the upper extremity of the mast to the top of the hounds, and is one sixth of the whole length of the mast.

The hounds are the shoulders produced by enlarging the diameter of the mast a few inches at the lower limit of the head.

To the sides of the hounds of the lower masts are bolted, and otherwise secured, fitted pieces of oak, of the shape shown in Plate 32, and called bibbs, (B C). These, with the hounds, form the foundation for the tressle-trees. The small part of the mast, just below the bibbs, is called the neck.

The partners, D, comprise the portion of the mast that corresponds, when it is stepped, with the height of the deck where the mast is wedged. The lower part of the mast, E, is called the heel, and the upper projection, A, the tenon.

The *doublings* of masts are where the head of one mast doubles on the heel of the other.

For length of main mast, add the length at the load water line to the main breadth, and take the half sum.*

The diameter of a mast at the partners, is one inch to every three feet of length; at the heel, six sevenths of that at the partners; at the top of the hounds, nine tenths; at the tressle-trees, three quarters; at the upper part of the head, six sevenths of that at the tressle-trees.

The foremast, in all its proportions, is nine tenths of the mainmast; the mizzenmast, in length, is thirteen fifteenths of the mainmast, and its other proportions five sevenths of the mainmast.

These lengths suppose the three lower masts to house the same amount (to step on the same level), if not, the allowance must be made accordingly. The bowsprit is five eighths of the mainmast in length, one third of which is inboard; and its diameter in the bed is the same as that of the mainmast. The heel is six sevenths of the bed, and the outer end two thirds of the bed.

The main-topmast is three fifths of the mainmast in length; head, one sixth of its own length; diameter at the cap, one inch to every three feet of length; at the tressle-trees, five sevenths

* The proper length of lower masts, has been a subject of much controversy from time immemorial. A writer on ship building thus pleasantly and sensibly disposes of the question: "As for the disputed advantages of long and short lower masts, we agree entirely with Sir Cloudesley Shovel, who says, with equal wit and wisdom, 'I mightily esteem short lower masts; for the shorter they are, the longer they will stand.'"

of the diameter at the cap; at the top of the head, six sevenths of that at the tressle-trees.

The top-gallant masts, in length, are one half of their respective topmasts. Royal masts, two thirds of the top-gallant masts; pole, one half of royal masts. The diameter of the top-gallant masts is nine eighths of an inch to every three feet of length; the same size up to top of hounds. Royal masts, in diameter, are four fifths of top-gallant masts.

All the spars of the foremast are nine tenths of those of the main; those of the mizzen-mast, five sevenths. The jib-boom is six sevenths the length of the bowsprit, and projects seven twelfths of its length; its diameter is one thirty-sixth of its length.

Yards, Booms, &c. The length of the main yard is ten elevenths of that of the mast; its diameter in the slings is one inch for every four feet of length; at the yard-arms, three sevenths the diameter at the slings. Between the slings and each yard-arm the spar is divided into four equal lengths, called quarters, and such diameter is given to it at these places that the outline of the spar, from the slings to the extremities, is a regular curve.

The yard-arm, or length of the yard beyond the shoulders for the rigging at each end, is one twentieth the whole length of the yard.

The main-topsail yard is three quarters of the main yard in length; the proportions are the same as those for the main yard, except that the lengths of the yard-arms are one eleventh the whole length of the yard.

The main top-gallant yard is nine fourteenths of the main-topsail yard in length; its diameter at the slings, seven eighths of an inch to every four feet of its length: at the yard-arms, three sevenths of that at the slings; the yard-arms are one eighteenth the length of the yard. The main royal yard is nine twentieths of the main top-gallant yard, and its proportions like those of the top-gallant yard.

All yards on the foremast are nine tenths of their respective yards on the main; those of the mizzen are five sevenths.

The spanker-boom is one half the length of the mainmast; diameter one forty-eighth. The swinging-boom is five ninths of the main yard; diameter one sixtieth of its length. Topmast and top-gallant studding-sail booms are one half of the yards on which they are placed, plus one half the diameter of those yards; the diameter of each boom is one sixtieth of its length.

YARDS, ETC.

The scarfings of all yards are in length about one third the length of the yard. Should the timber not be long enough, they may be made less. They should be put together with lignum-vitæ coaks or dowels, about two feet apart. The hoops to be once and a quarter the diameter of the yard apart, and those over the nibs, or ends of the scarfings, to be wider and thinner than the others. The spanker-gaff is four fifths of the boom.

The yards, booms, and masts are usually made of yellow pine and spruce. The latter is selected for small spars.

The dolphin-striker is one half the out-board part of the jib-boom, its diameter one twenty-fourth its length. The whiskers are the same as the dolphin-striker.

The main top is, in breadth, one half the moulded breadth of beam, and in length, two thirds of breadth. Tops are constructed of two thicknesses of white or yellow pine, with the *rim*, lubber-band and battens of white oak. The upper cross-trees are fayed down over the battens, and secured to the lower cross-trees by bolts at each end, and by four staples and toggles, so as to be readily removed when it is necessary to lift the top.

EXPLANATION OF PLATE 32.

The Bowsprit is represented in full length. At the side the *bees* are shown extending from the cap to the *housing*, or where the octagonal form commences.

The parts marked 2, are of iron and to them shackle the hearts for the inner, middle, and cap bob-stays.

The bowsprit cap is iron-bound. To an eye-bolt on the lower side is hooked the dolphin-striker.

Above the strap for the middle bobstay is an eye-bolt, to which hooks the whisker.

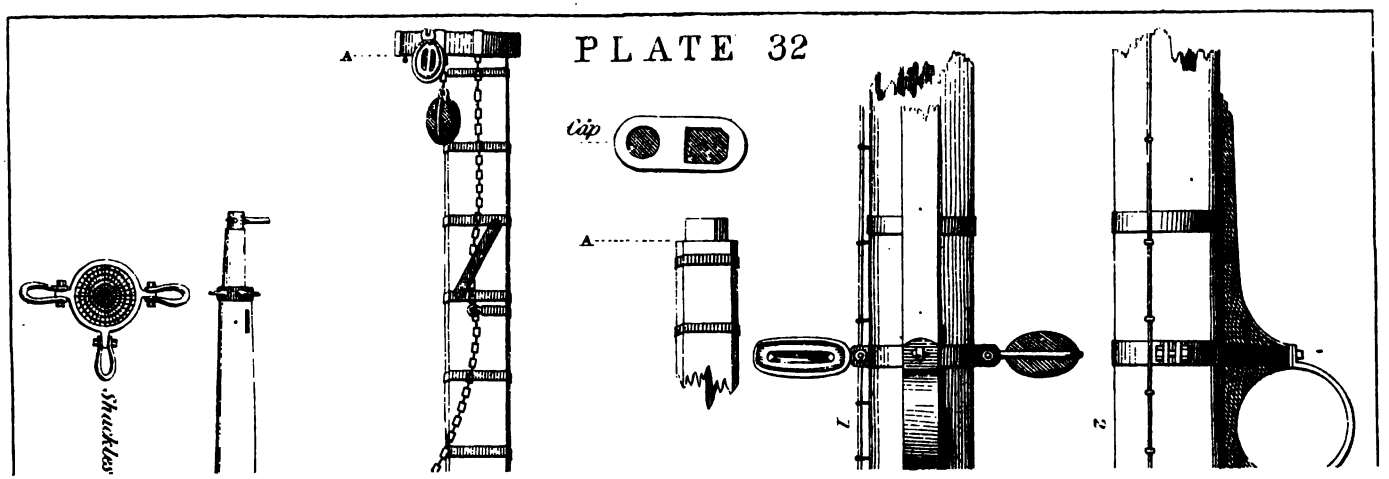
Next outside is a sheave for the fore-topmast stay. An iron strap marked 1, containing a heavy, solid thimble, is for the fore-stay. There is one on each side.

Eye-bolts are represented on top of the bees, for bowline blocks.

The eyes to which shackle hearts for bowsprit shrouds are not represented.

The Jib-Boom is represented in its place. The heel is cut to fit in a saddle bolted on the top of the bowsprit, and is clamped down by an iron strap; a short distance outboard is a sheave for a *heel-rope*.

PLATE 32



EXPLANATION OF PLATE 32.

Just inside the hounds is a sheave-hole for the jib-stay. Over the hounds fits an iron band having three shackles; one for the jib martingale stay, and one aside for the jib-guys. Immediately outside this band is a score for the fore-top-gallant stay.

Lastly comes the *wythe*, a species of iron cap to support the flying jib-boom.

The Lower Mast has the cap on. To an eye in each end of a strap passing over the cap, shackle the chain slings for the lower yard. A back-strap about halfway down the mast-head, gives it a better lead. The hook in the end of the slings is not the most approved pattern. One similar to a slip-stopper, Fig. 385, Plate 73, is in more general use.

The double block, strapped to an eye-bolt in the cap is for the lower lift. The single block is the *top-block* for sending up the topmast. The chafing-batten is shown on the forward side.

The tressle-trees are in place. Just below the bibbs comes the band for the patent-truss, and below it the futtock-band to which shackle the futtock-shrouds.

The Topmast has, a few feet below the cross-trees, a metal band with rollers on either side for the top-gallant shrouds. This obviates the necessity for futtock-staves and cat-harpins in the topmast rigging.

The forward part of the tressle-trees has a clamp. By opening this the sending up and down of the top-gallant masts is greatly facilitated. The eye-bolts under the tressle-trees are for the hanging-blocks for the head-halliards.

One gin-block, for topsail-tye is represented in its place. It should be hooked to the eye of a strap fitting *over* the tressle-trees and between the doublings.

In the forward part of topmast cap, are eye-bolts for the top-gallant top-block, and standing part of top-gallant mast-rope. Fitting over the topmast cap is an iron strap with a link in each end for block of topmast studding-sail halliards.

The Lower Yard has in the centre a stout iron span, to which hook the slings.

The two lower blocks are for the topsail-sheets. The two partly concealed are for the clew-garnets and hook on the forward quarter.

On the after side of the yard is nailed a chafing-batten.

Next outside is the quarter-iron for topmast studding-sail boom.

THE RUDDER.

Take the ends of the hawser forward to each gang-way to act as guys; sway up, guy the rudder fair, so that the pintles are fair for entering the gudgeons, then lower away, fit the wood-lock and bolt it. Come up the purchase, unreeve the guys (hauling the toggle out by the laniard, jerking the hitch adrift and hauling the hawser through on the side of the knot), ship the tiller, reeve the wheel ropes, shackle the rudder chains, and stop up the pendants.

The tiller of a sailing vessel is shipped in a mortise in the rudder-head. Two pieces of iron, *a a*, Fig. 273, are put on each side of the mortise before the rudder is shipped. The pieces of iron are prevented from coming out by the two shoulders, *b b*. The ends, *c c*, of these pieces, are put through holes in the small vertical projections, *d d*, and are set up with nuts, *e e*. These pieces, called flanges or dogs, prevent the tiller from unshipping.

The band, *f f f f*, around the rudder-head, is of iron.

Second Method. The rudder for sailing and screw ships differs in the construction of the head; that for the latter being shaped to receive an iron yoke (fig. 271). Should there be no beam wherein to place the eye-bolt for the top-block, a pair of sheers or a stout spar, lashed across the rail over the rudder-hole, may be substituted.

An improved method of securing the rudder chains, is to shackle them to the eye in the extremity of a stout iron bar projecting from the rudder as at B.

During the Exploring Expedition, the rudder-head of the Vincennes becoming so much decayed that the tiller was useless, stout pieces of oak were bolted to the rudder on either side, so as to project similar to B. These "out-riggers" were connected, by means of luffs, to spars lashed on the quarters and the vessel steered in that way.

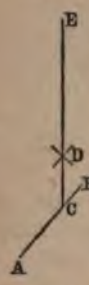
EQUIPOISE RUDDER.

Since the introduction of the screw-propeller and very long ships, the effort has been made to increase the water surface of the rudder with a view to an improvement in steering. The objection to some of these inventions is that the great increase of resistance brings too much strain upon the rudder-head and tiller, rendering the former liable to be twisted off. Still, where the draft is light in comparison to the length, an increase in the breadth of the rudder, over the old pattern, is indispensable.

The most successful design, so far, and one in which the difficulty just stated is overcome, seems to be the pattern adopted for the rudders of the iron-clads.

THE RUDDER.

Thus:



Where C E, represents the after portion of the keel; D the screw, and A B the rudder, made of iron and working at one third its breadth, on an iron spindle, or after-stern post C. Now if the helm be put a-starboard, for example, then A C, two thirds of the entire breadth, present the desired surface to the action of the water, but the strain on the tiller, is diminished by the one third B C, which acts in conjunction with it, by the water acting on the surface from B to C.

This is called the Equipoise Rudder.

Back-Chains. It is frequently necessary for steamers to back against the helm, but in doing so, the strain brought on the rudder and its fitments is immense. So much so, indeed, that in the double-enders, where the securities were inadequate, the rudder, in a number of instances, was wrenched entirely off and lost.

Tug-boats guard against such accidents, by using *back-chains*. These are chain-pendants which attach to the after-part of the rudder and to some point under the counter, one each side, and of such a length as to give ample support to the rudder when backing with the helm hard over.

CHAPTER VIII.

CUTTING AND FITTING RIGGING.

THE rigging of a ship consists of a quantity of ropes, of various dimensions, for the support of the masts, yards, and booms.

Each mast is supported from forward by *stays*, from aft by *back-stays*, and sideways by *shrouds*. The foremast is supported, in a great measure, by the bowsprit, therefore the bowsprit has an extra number of stays called *bobstays*. These, and such ropes as are stationary, constitute the STANDING RIGGING.

The topmasts can be sent up and down by means of *top-tackles;* the top-gallant masts, by *mast ropes*. Each yard is sustained at the centre by slings or ties, and at the extremities by lifts; and are moved about by braces. Sails are set by the halliards hoisting them and the sheets, which extend the lower corners, or clews, and they are taken in by downhauls, buntlines, clewlines, &c., &c. These, and others reeving through blocks, comprise the RUNNING RIGGING.

The "Book of Allowances" contains tables for calculating the size of rigging for each class of vessel in the navy. But, in the present course, it is presumed that none of the conveniences of a navy-yard, or books of tables, are at hand. A general idea of proportions is sought to be imparted, and a seamanlike manner of fitting rigging, leaving it to the intelligence of the officer to modify or improve upon this general guide as circumstances may admit.

The following was the rule some years ago for finding the size of standing rigging, and will be found to hold good still for sailing vessels and for the larger class of steamers.

For the size* of fore and main shrouds allow one inch in circumference for every 10 feet of mast in length. For mizzen shrouds, one inch of rope for every 12 feet of mast.

All standing stays are once and a half their respective shrouds.

Topmast shrouds three fifths their respective lower shrouds.

* The foremast is supposed to be nine tenths of the mainmast in length.

CUTTING RIGGING.

Top-gallant shrouds five sevenths the topmast shrouds.

Fore and main topmast backstays, the same size as the mizzen shrouds.

The mizzen topmast backstays, same size as main topmast shrouds.

Fore and main top-gallant backstays, the same size as the mizzen topmast shrouds.

Mizzen top-gallant backstays, same size as the main top-gallant shrouds.

Jib-stays, same size as the fore topmast shrouds.

Jib-guys, size of main topmast shrouds.

Top-pendants, topsail tyes, and sheets, are of the same size as topmast shrouds.

Bobstays, size of main rigging.

Braces and lifts the size of corresponding laniards.

All laniards should be one half the size of their respective shrouds.

Topsail halliards, one half their tyes.

Braceblocks should be in length the diameter of their yards in the slings.

For dead eyes, allow $1\frac{1}{2}$ the circumference of their shrouds.

Fore and main tack and sheet blocks should be but little over twice their respective tacks and sheets.

Scale Draft. There are several methods of measuring for rigging:—measuring on a draft of the vessel and spars; measuring, with a line, the masts while in the spar-shed or elsewhere, and the vessel's half beam abreast the partners; and measuring, after the masts are stepped, the exact length of each leg of the shroud and stay.

Cutting out by draft is much preferable, and the draft itself is so easily constructed that it should always be drawn. In mechanical drawings, the unit of measurement is generally a foot, which is subdivided into inches to correspond to the common foot rule. For working drawings, the scale is generally large A very common mode of laying down working drawings is to use a scale of one and a half inches to the foot. This gives one eighth of an inch to an inch, which is equal to one eighth of the full size. This is very convenient, as the common foot rule is in such general use, and so familiar to every one. Scales are generally made to suit each particular case, dependent on the size

PLATE 33

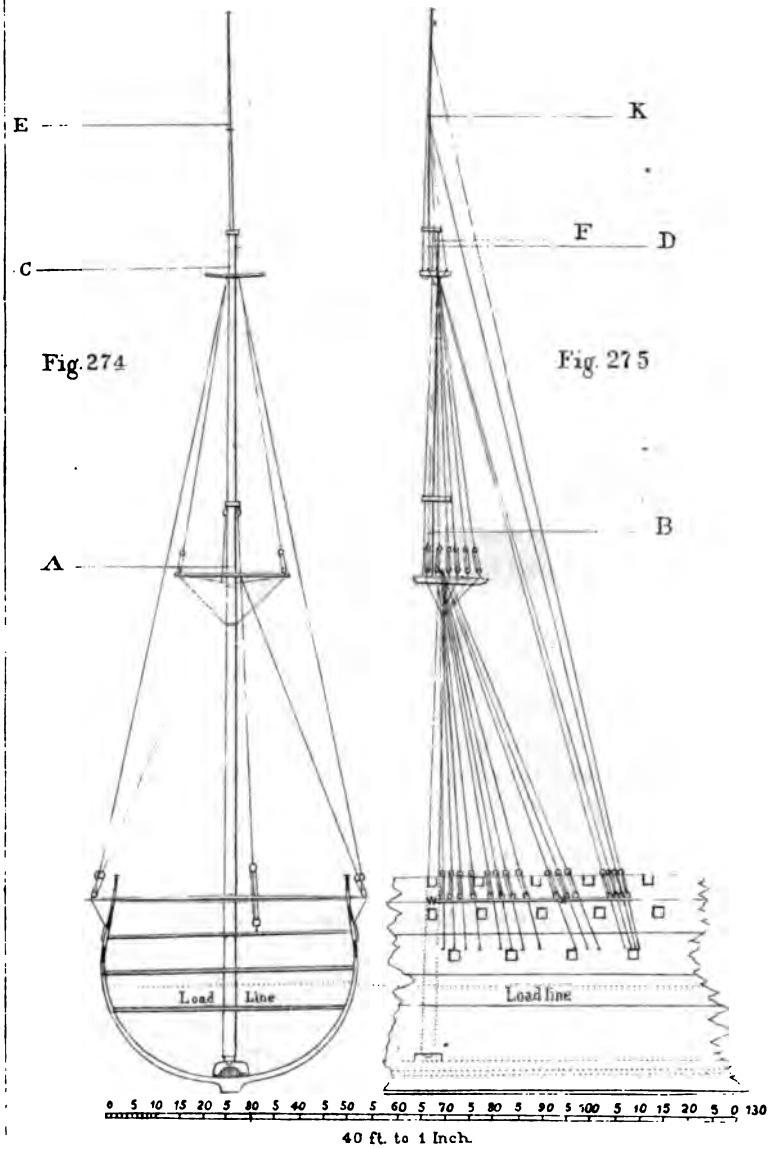


Fig. 274

Fig. 275

40 ft. to 1 Inch.

of the object to be represented and on the size of the paper or board on which the drawing is to be made. A scale of one eighth might be inconveniently large, therefore any smaller unit may be adopted. A scale on which the half of an inch represented eight feet might be more convenient. Having decided upon the unit of measurement, draw the body and sheer plan upon the adopted scale, the former representing the cross section abreast each mast and the latter giving the length of the channels, showing the position of each dead eye, &c.

Cutting Rigging by Draft. Having an accurate draft of the hull and spars of a ship, Fig 277, Plate 35, the measures may be readily taken and the rigging cut and fitted so that it can be sent aloft as soon as the masts are ready to receive it. Indeed, it not unfrequently happens, that a gang of rigging is completed and triced up out of the way, in the rigging loft, long before the ship is ready to take it.

To cut by a draft, it is necessary to have a beam draft,* giving the breadth of beam and width of channels abreast each mast; the breadth of each top and length of cross-trees; also, a fore-and-aft draft, giving the length and rake of each mast, the length of the channels, and the positions of the lower dead eyes, as well as those of the tops. A plan of the bows from the foremast to the knightheads, the bowsprit, head-booms, and whiskers, is also necessary.

Lower Shrouds. At one half the circumference of the mast-head above the bolster, place on the respective mastheads a mark A, Fig. 274, Plate 33. With a pair of dividers, take the distance from this mark to the upper edge of the channels and transfer it to the fore-and-aft draft by placing one foot of the dividers on the channels in the wake of the forward dead eye, and the other foot on the mast-head, and mark this point as B, Fig. 275. This distance, increased by the diameter of the shroud, is the length of the forward leg of the first pair of shrouds. From the mark B, on the mast-head to the upper edge of the channel abreast the second dead eye, plus the diameter of the shroud, gives the length of the after leg of the first pair. Measure for each succeeding pair of shrouds in the same manner, adding to each leg of No. 2 pair, twice the diameter of the rope; to each leg of No. 3, three times the diameter of the rope, &c.

For Lower Stays. Measure from the after part of their respective mast-heads to the place where the stay sets up, adding the length of the mast-head for the collar. Stays should always

* The beam draft is often omitted in practice, when the *half-beam* is laid off in the channels, as W. X.

CUTTING RIGGING.

have end enough turned up to allow for splicing in case of their being shot away.

Topmast Rigging. At one half the circumference of the topmast head, above the bolsters, place a mark, C, Fig. 274. With a pair of dividers, take the distance from this mark to the top rim, and set it off on the fore-and-aft draft by placing one point of the dividers on the upper edge of the top, in the place of the forward dead eye, and the other on the mast head, as at D, Fig. 275. This distance, plus the diameter of the shroud, gives the length of forward leg of first pair of shrouds; for the after leg, measure from D to its own dead eye on the top rim, and so on for each successive pair.

For Back Stays. With the dividers take the distance from C to the upper edge of channels and transfer it to the fore-and-aft draft by placing one foot on the edge of channels abreast the mast, and the other foot on the mast-head, marking the point as at F, Fig. 275. For the forward leg of the first pair of backstays, measure from the mark F, on the top-mast head to the place of its own dead eye, adding to this the diameter of the pendant, if fitted of rope, and of each successive pair of shrouds it has to go over. For the after leg, measure from F to its own dead eye, adding as with the forward leg. Measure in the same way for the second pair, adding the diameter of the pendant, for all the shrouds, and the first pair of back-stays.

Top-Gallant Rigging. At one half the circumference of the top-gallant mast-head, above the hounds on the beam draft, place a mark E. Take the distance from this mark to the upper edge of the top, and transfer it to the fore-and-aft draft, as already shown, and mark it K, Fig. 275. For forward leg of first pair of shrouds, measure from K to its bull's-eye, in the top, and to this distance add half the length of its cross-trees and once the diameter of the rope; for after leg, measure in the same manner.

Top-Gallant Back-stays. Measure as for topmast backstays.

Royal Rigging. Proceed in the same manner as for top-gallant rigging, adding one half of the length of the jacks for the shrouds.

The rigging should be measured and the diameters added while on the stretch, the diameter being measured with the service on the rope. The circumference of the mast-head is to be taken directly above the bolsters. An allowance should be made for any material difference in the breadth of the forward, and after part of channels, and the difference of the plane of the spar *deck and* that of the channel.

PLATE 34

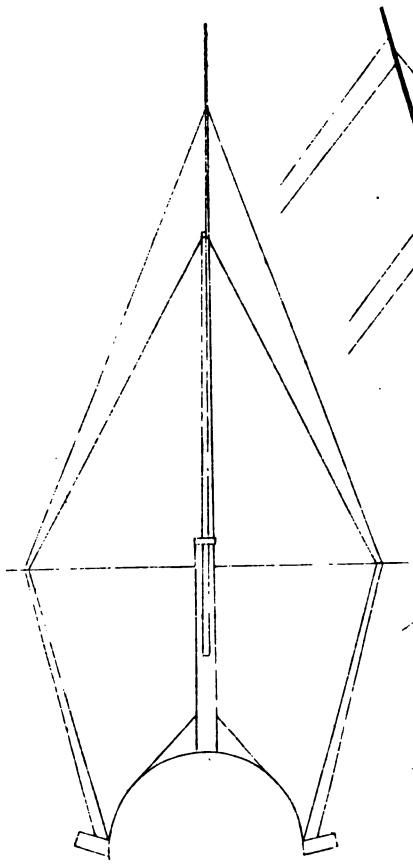


Fig. 276 *a*

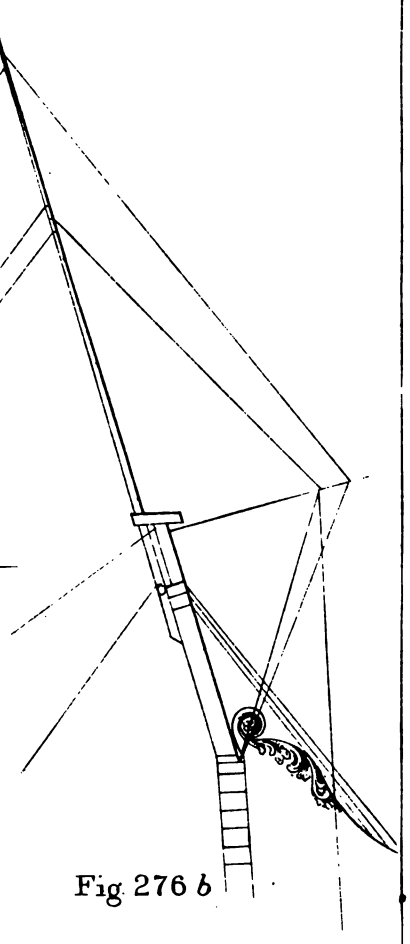
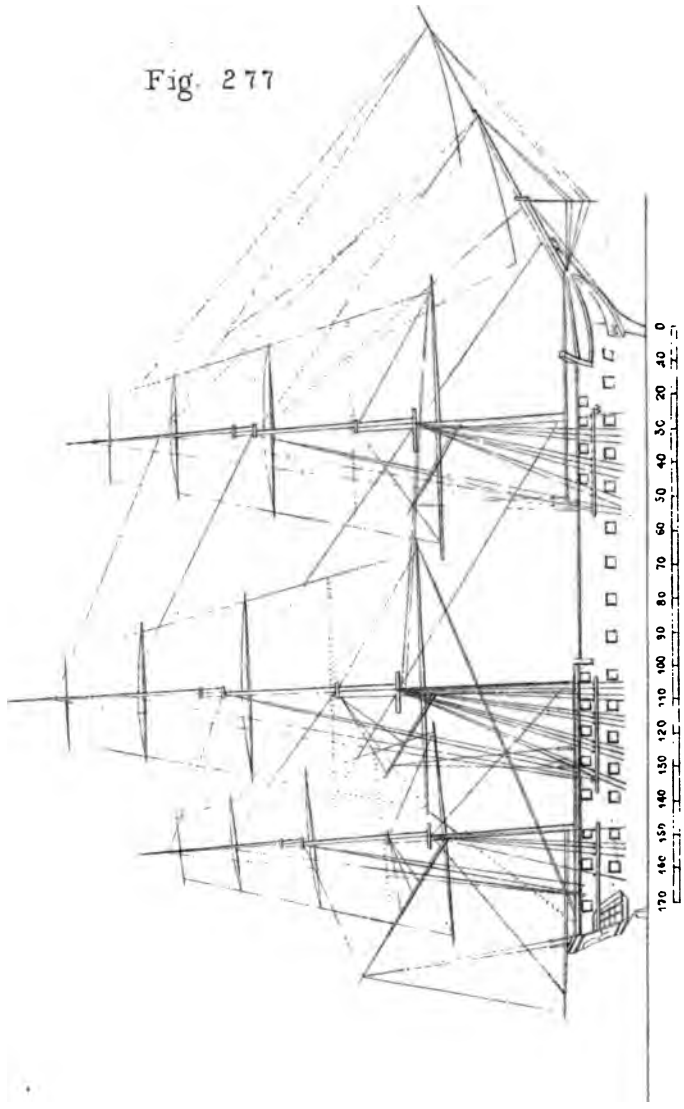


Fig 276 *b*

PLATE 35

Fig. 277



Scale 55-1 Inch

CONSTITUTION

Half Breadth at Fore Mast to outside of Channel 20 feet 7 inches.

" " " Main " " " " 21 " 2 "

" " " Mizen " " " " 12 " 10 "

CUTTING RIGGING.

The proper length of each shroud and backstay can be obtained from a draft, Fig. 277, Plate 35, having the *breadth of beam at each dead-eye marked upon it*, and by measuring for each in the manner directed. Measure for stays according to their lead and the manner in which they are fitted. If they set up with dead-eyes or hearts, measure from after part of mast-head to the place of setting up, to which add the length of mast-head. If they set up on their ends, measure in the same way, following their lead and allowing a few feet for the end to turn up.

Bowsprit Rigging, and that for the head booms, is measured for on the draft, Figs. 276 (*a*), 276 (*b*), Plate 34, and needs no particular description.

This method of measuring for rigging is very exact, and is recommended particularly for wire rigging, which is always cut on the stretch, as it avoids waste.

In the absence of a regular draft of the ship, it is very easy to construct a scale drawing. On the mast (wherever it may be), measure the distance from the point which comes flush with the upper deck when stepped, to the upper side of bibbs, and add to it the height of the tressle-trees and bolster. Lay off on a vertical line, drawn to represent the mast, this distance reduced to the desired scale; and on a horizontal line, drawn from its base to represent the spar deck, lay off the distance from the centre of the mast-hole to the outer edge of the channels abreast the foremost dead eye, also reduced to the scale. Now draw a line from the top of the perpendicular to the extremity of the horizontal line, that is, from the top of the bolster to the outer edge of the channels, and it will be the distance to lay off on a fore-and-aft draft, which may be similarly constructed, and proceed as described in the foregoing, making an allowance in your first pair of shrouds for the mast-head pendants.

Without a Draft. Having the mast in, and without a draft, the simplest and most accurate method of measuring for lower rigging is as follows: Send a hand aloft by the girtline, and let him pass around the mast-head, just above the bolster, a piece of 9 or 12 thread stuff, long enough to permit both ends to reach the channels; stop the two parts at the mast-head together, so as to form an eye, and take the two ends to the two forward dead eyes in the starboard channels, and at that distance stick in a yarn, marking with one and two knots, respectively; then measure the third and fourth dead eye, and so on, marking each with a knotted rope yarn. Now take the line down, and check off, on deck, the length of each pair of shrouds, allowing, in the first pair, for the mast-head pendants, and to each successive

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pair adding twice the diameter of the rope, or, more properly, of the fitted eye. For the port shrouds, the length will be the diameter of the rope, parcelled and served, added to the length of the corresponding pair on starboard side.

For Bobstays. Take twice the length from the hole in the cut-water to the bowsprit where their respective collars are, or hearts shackle.

For Bowsprit Shrouds. Measure with spun yarn, from the eye-bolt in the bows to the heart on the bowsprit.

For Fore-and-Aft Stays. Measure from after side of mast-head to place of setting up, adding the length of the mast-head for the collar.

The old plan to measure for and cut lower rigging, was as follows: Measure the distance from the port side of the mast-head to the foremost dead-eye in the starboard channels, which distance set off on the floor of the rigging loft, and stick in a marline-spike or post at each extremity. The shroud stuff being stretched, stop one end to one of the marline-spikes or posts; take the bight round the other and back again: this is the first pair of shrouds; pass it round again, *outside at each end*, for the second pair, and continue in this manner until one gang of rigging is completed. Mark the length of the eyes straight across at the *opposite end*, to the one stopped to the marline-spike; cut at the latter in an angular direction (so that the after-legs will be a little longer than the forward ones), and the inside pair will be the first pair of shrouds. Hitch a piece of spun-yarn round each shroud, in the centre of the eye, making knots on it according to the number of the shroud, commencing the inside pair with one knot. The mark for the length of the eye gives the place for the eye-seizing; the round of the rope giving their place on the mast-head.

This method is wasteful and obsolete, and since a draft is so easily constructed it should always be used.

Having the requisite measures, then commence to cut and fit the standing rigging:

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Mast-head Pendants, Fig. 278, Plate 36, when fitted, should be the length of their respective cross-trees; in which case, the *after* one would be the longer. The custom appears to have had its origin in the calamities incident to the sea; and the forward legs, by being shorter, were probably designed as a substitute, in the event of the yard-slings being shot (or carried) away; while the

after ones, on account of their superior length, could be employed (in connection with tackles) to support the mast, without interfering with the yard in case of a similar accident to the lower stays.

In fitting the pendants, splice a large thimble (well parcelled) in the ends of each, thrusting the strands of the splice once and a half; and after scraping them down, serve about a foot above; observing, in all cases, where a thimble is spliced in, in this manner, to pass the turns of the service *towards* the thimble. Thus fitted, the pendants are wormed, parcelled and served in the wake of the mast-head; after which, they are spanned together with small stuff on each side, enclosing half the square of the mast-head, from the centre of each. The span is parcelled over.

The following rule is frequently given for cutting mast-head pendants; the forward pair, twice the length of the mast-head, the after pair twice and a half.

The size of pendants is that of the lower shrouds, viz.: for first-rates, 10 inches for the main.

Lower Rigging. Get the shroud-warp on a stretch, or rather one end of it, long enough for one pair of shrouds; mark off the distance for the required service, and when completed—being wormed, parcelled, and served, while on a taut stretch—measure the length with a tape-line, from *draft* of first pair of shrouds, No. 1 starboard; when measured and chalked the required length, "come up the stretch," and cut at the chalk-mark: middle the shroud at the centre of the service, and lay it on the loft floor. Continue fitting and cutting, in this way, until you get the number of shrouds required for the gang.

To Form the Eye of a Pair of Shrouds. The proper length for the pair being on a stretch, divide it into thirds. The centre of the middle third will be the centre of the eye when formed. Serve over the middle third, commencing by tarring the rope: worm it, put on tarred parcelling with the lay of the rope, working from the ends towards the centre, where the parcelling may be doubled. Commence serving where the parcelling left off. The service should be hove on as taut as it will bear. The size of the eye is five fourths, or once and a quarter the round of the mast-head above the bolsters. The parcelling is put on as described that it may shelve downward and thus shed water. The service should be four-yarn spun yarn.

Come up the luffs and bring the two ends of the shroud together. If the centre third is very stiff, break in the eye by passing a small rope round both parts of the shroud, taking three or four turns; then with a couple of hands seated on the floor on

each side, with their feet against the shroud; haul on the ends of the rope and bring the two parts together, when clap on a temporary yarn seizing; or the two parts may be hove together by a Spanish windlass, the strand for heaving on being placed a little above the place for the seizing.

For the Eye Seizing, put a piece of tarred parcelling round the two parts of the shroud, to pass the seizing on; this is to protect the shroud and allow the turns to lay fair and smooth. The seizing will be about four fathoms of 15-thread stuff. Splice an eye in one end, sticking the strands once: do not trim off the ends. Having well stretched it, pass the eye around the shroud and reeve the end through it; wind, say seven turns loosely round both parts of the shroud, reeve the end through the turns and through its own eye, leaving slack enough to heave on. Two strands of the splice are laid down the shroud, the turns of the seizing to lay over it. Make a yarn fast to the third strand and pass it round the shroud above the seizing to keep the eye in its place, or on heaving the first turn taut, it will render too far round. Lay the first turn fair and square with the shroud and heave it taut, using a marline-spike or serving mallet as a pry, after all the under turns are hove taut on, haul the slack through the eye and heave it taut. Take the yarn off the third strand, laying the latter on top of the lower turns, and pass six riding turns over it; pass the end down between the last two of the under turns, and cross the seizing, forming a clove-hitch with the cross turns, unlay the end, make a crown knot, cut off the ends and tar the seizing.

The width of the seizing should be about equal to the diameter of the shroud.

The seizing of the first pair of shrouds is passed upwards *toward* the crown. All the other seizings are passed *from the crown* once the diameter of the shroud below that passed on the preceding pair, so that when the rigging is placed, they may be in the same right line, parallel to the tressle-trees. For a 10-inch shroud, allow 18-thread stuff for the eye seizing; for 8-inch, 15-thread; for 7½-inch, 12-thread.

It is scarcely necessary to say, that whenever riggers' screws are available they will be used in place of the Spanish windlass, if practicable.

For first rates, the size of lower rigging is as follows: Fore and main, 10 of 10¼-inch; mizzen, 6 of 7-inch, the latter including the pendant.

The laniards are respectively 5¼-inch and 3½-inch. The size of lower rigging diminishes one inch for each succeeding class of vessels.

FITTING RIGGING.

Turning in Dead-Eyes. If in the loft, get the length from the mast-head to the deck, from the draft, if the masts are not stepped, and place the dead-eye to that length, making due allowance for stretching in setting up.

The principal caution is to keep the lay in the rope, as it prevents the wet getting in. If the shroud is to be wormed and served in the wake of the dead-eye, the worming should not be hove in too taut, as breaking the shroud round the dead-eye would probably snap it.

The score being well tarred, the end of the shroud is taken underneath, round the dead-eye, inside standing, or mast-head part; a bolt is put in a hole of the dead-eye. Take a good strand, knot both ends together; it is then middled and crossed round the end of the shroud; both bights are taken round the bolt, one on each side of the dead-eye, and a smaller bolt put in each of the bights, which are hove round the large bolt in the dead-eye. As the turns accumulate, it heaves the shroud taut round. The dead-eye should be secured through one of the holes, with spun-yarn, to the shroud before heaving, where the shroud is marked, for the lower part. When the dead-eye is turned in, in a loft, the shroud is hove in with a jigger (or dead-eye machine).

When the shroud is hove well round, pass a good throat-seizing. When secured, take out the bolts, get a smaller jigger, hook one end to a strap round the end of the shroud, and the other to the mast-head part; take a good strand, knot both ends together, take it round the end and standing or mast-head part; put a bolt in both bights, and heave it round, pulling up the jigger at the same time; this will bring the end taut up, as heaving on the strap brings both parts close together; then pass a round or quarter seizing, and a smaller one on the end.

If the rigging is turned in on shore, keep the lay in the rope, and when sent out of the loft, to be placed on the mast-head, keep the ends inside, the shrouds being marked with a knot, according to the number, using marline for the fore and houseline for the main. The ends will lay aft on one side, and forward on the other; this is of importance and should be remembered.

In an English work on seamanship (Boyd's Naval Cadet's Manual), will be found the following directions for turning in dead-eyes. The extract is given not only to show how we do *not* perform this operation, but also to illustrate how much may be said in the vain endeavor to make a very simple matter clear by a written description. Whereas, accompanied by a practical seaman, a few minutes spent in the lower rigging of the school

ship, would be better than a chapter of the most lucid explanations.

"There is," says the author, "a confused and unmeaning way of speaking about 'TURNING IN DEAD EYES.' One says, 'with the lay;' another, 'right-handed;' another, 'with the sun;' another, 'pass the end underneath the up and down part;' another, 'throw the end to your right,' etc. Let us speak about the right way.

"Take a piece of small right-handed rope, and hold about six inches of it taut out in both hands; twist it up tightly, and keep twisting as you bear your hands toward each other; the rope will make a natural curl, Fig. 279, Plate 36.

"You have, in making the 'turn in,' kept the turn or twist in the rope; it is now as closely laid up at the bent part as any other, and consequently, as little open to receive wet.

"Again, with a similar piece of rope, untwist, and on bearing your hands together, it will form a natural curl. Fig. 280.

"You have taken a turn out, and the strands lie open to wet.

"It is true that, in making a turn with a large rope, you would *neither twist* nor *untwist*, but nearly the same effects would be produced.

"Whether, then, in the loft or in the nettings; whether with our own shroud rope, which is always right-handed rope, or with foreign, which is sometimes left; the only thing necessary to consider in the matter of turning in a dead-eye, is to keep the turn in the rope, the reason being 'so as to keep the wet out.'"

"If the shrouds are to be *ends up*, put a dead-eye in the first curl, as in Fig. 279, with its upper hole next the cross (the score being always well tarred first), pass spun-yarn seizings through the lower holes round the sides of the curl to keep the dead-eye in its place. With a bolt through the upper hole, Fig. 280, and a strand, rig a Spanish windlass, and heave the end close to, and taut in ('breaking in,' is the term), pass a throat seizing round the cross," etc.

This certainly appears very lucid and very reasonable; but it is *diametrically opposed* to the method practised by our seamen. We take the turn as in Fig. 280, and "neither twist nor untwist the rope," as justly observed; *but it is in breaking the end up* that the lay is opened, when the first plan is adopted, consequently we take the turn "with the sun" when using right-hand rope—a direction clear enough for seamen.

Dead-eyes are made now, both patent and old-fashioned, with one hole without a score on the inside, the edge being left square

PLATE 36

Fig. 278

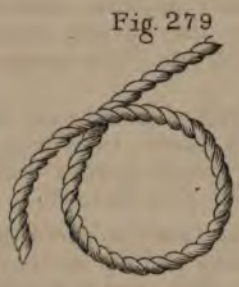


Fig. 279

Fig. 280

Fig. 281

Fig. 282

to present a firm and solid shoulder to the knot of the laniard, so that a mistake seems impossible.

To turn in Cutter Stay Fashion, Fig. 283, Plate 37. Put a temporary seizing on the cross of the curl as in Fig. 280, Plate 36 carry the end round the standing part, and heave it taut alongside its own part; then seize those two end parts together with a throat seizing, making the eye as small as possible, put a quarter seizing (a flat one) on as well, about six inches nearer the end: cut the temporary seizing on the cross, open out the clench, put in the dead-eye, drive the clench down, keeping the dead-eye with a little cant against the pull of the laniard.

Two seamen should turn in a dead-eye, with 11-inch rope, in a workmanlike manner, in two hours.

The cutter-stay method had its origin, as its name indicates, in the forestays of cutters. As a sail was set on the stay, this plan admitted of its hauling down snugly.

It is thought by many to be a neat plan for lower rigging, but has never been favorably regarded in our service. Fig. 283, is a fair representation of the plan with an improvement in the method of securing the standing part of the laniard by splicing it into an eye-bolt in the channels.

GENERAL REMARKS ON TURNING IN DEAD-EYES.

Let three shrouds, cut from the same warp, have dead-eyes turned in, each one by a different method, viz.:—one to have the dead-eye spliced in; another similar to a cutter's-stay, and the third to have the dead-eye secured by a throat and two end seizings. In order to ascertain the actual strength of these three different methods, repeated experiments have proved that under the pressure of a breaking strain, the rope would first give way at the neck of the splice. The next weak point will be found in the cutter's-stay plan, at the nip in the main part of the rope, where it is compressed by the bight which passes around it. The third, or old plan, if the throat and end seizings are well and properly secured, will break the main part of the rope at the maximum strength. As each of these methods has some merit and corresponding disadvantages, it may be well to consider each of them.

The splice is never used for this purpose except where the rope is short, and it is well known that a splice is weaker than the rope itself by about one eighth.

The cutter's-stay plan has the advantage of holding well, and it admits a sail, when set upon the rope, to be hauled close

down; but on the other hand, it is weaker than the main part of the rope, about one tenth, principally caused by compression of its own running-eye, which reduces the sectional area of the substance at that spot, and renders the rope less durable.

With respect to the old plan, it was found, upon some occasions, that when the shroud was long exposed to a hot sun and heated atmosphere, the throat and end seizings did not hold the rope firmly; but there are several different methods of applying the throat and end seizings, each and all of which have been found by experiment to be stronger than the main part of the rope at the cutter's-stay nip; therefore, *the old plan has strength and durability to recommend it.*

The Patent Dead-Eyes. In the testing-machine where these trials were made, the strength and durability of large hemp cables were experimented upon. Some of the cables measured as much as twenty-five inches, and contained 3,267 yarns, and of all the difficulties which presented themselves in the experiments, that of holding the hempen cable in the testing-machine proved the greatest. It was absolutely necessary so to fix the rope in the machine, that the full strength might be ascertained without injury to the outer yarns by chafe or pressure in the operation. All the various modes of splicing and knotting were found, upon trial, to be weaker at the neck of the splice or knot than at the main part of the rope; and it was likewise found, that the method which answered well with a small rope failed entirely with a large one.

After many fruitless endeavors to succeed by the various methods just stated, it became evident that the way shown in Fig. 284, Plate 37, was the best that could be devised.

For which purpose it was found necessary to cut the pieces of large cables about fifty-two feet long, and turn each end back about twelve feet along the main part of the rope, with a strong, heavy thimble in each bight, well secured with racking lashings, leaving three or four feet of the middle of the rope entirely clear. By this process, when carefully executed, it was invariably found, that the full strength of the rope was clearly ascertained.

This is precisely our present plan for turning in lower rigging, with the patent dead-eyes, as will be seen in Fig. 285 and 287, Plates 37 and 38, and it is directed in the Book of Allowances, that the under turns of the throat seizings shall be passed with racking turns. The end of the shroud passes around a heavy iron thimble, which is confined by a *square* pin or bolt, to the lugs of the iron strap of the dead-eye, Fig. 286. From this it appears that the present method of turning in our lower rigging, is the *neatest and strongest yet devised.*

PLATE 37

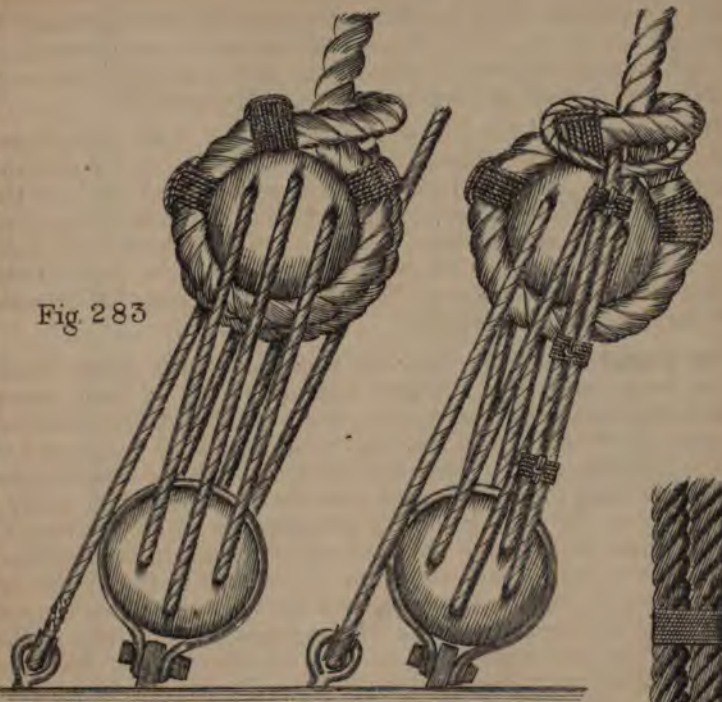


Fig. 283

Fig. 284

Fig. 286

Fig. 285

PLATE 38

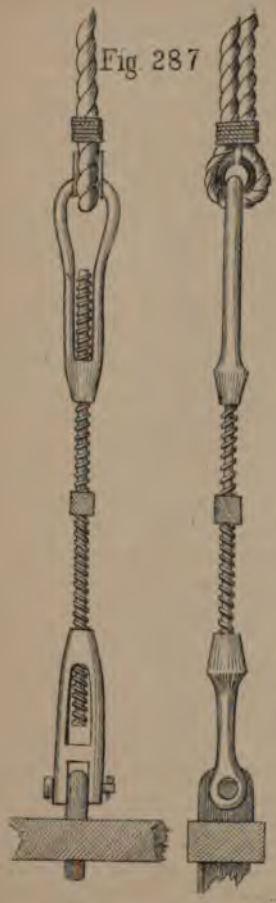


Fig. 287

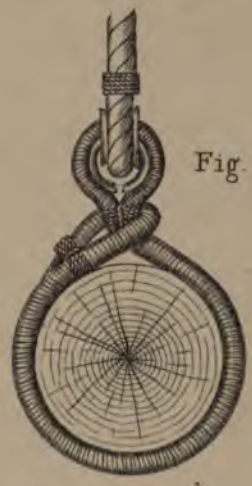


Fig. 288

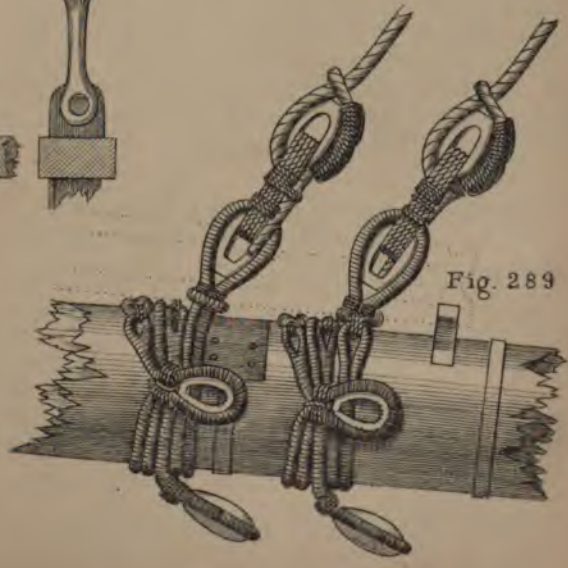


Fig. 289

FITTING RIGGING.

Rigging Screws. There is still another plan of setting up rigging, as represented in Fig. 287, Plate 38, by screws. These screws have been tried in a number of our ships, and found to answer well. When not to be used, a small iron plate keys on top of the screw, which keeps it from working, and the thread should be thickly smeared with tallow, covered with parcelling and marled. Whenever screws are used, it must be remembered that sufficient end should be turned up to allow it to be turned in afresh after knotting or splicing, in the event of its being shot or carried away. The same contingency should be provided for in all rigging.

Lower and Topmast Stays. Stays are four-stranded, and both the standing and spring stays are now the same size, and lash abaft the mast-heads. The legs are sometimes made for the collar in laying up. When sufficient length is laid up for the stay, from where the collar commences to the end for setting up, two strands, one for each, are left sufficiently long to double back, and are then laid up as four strands, forming the lashing eyes and legs. The ends of the strands are then unlaid, the inside ones wormed into the lay of the rope; the other strands are divided, laid up, and worked in alongside the first strands; then some more yarns are twisted smaller and used as backing; some inside yarns for each strand should be wormed into the stay their whole length, below the crotch; the legs are then wormed, so as to completely fill the rope, commencing from the centre of the eyes for lashing, which should be well opened with a large setting fid, and worming carried into the stay as far down as the worming of the legs. The outside yarns of the legs are then marled down, over all, round the stay, tapering the ends. The legs are well parcelled and served, and likewise the stay, sufficiently far down to take the lower yards, and covered with tanned hide.

The stays should be hove well out with purchases, and allowed to hang, pulling up occasionally.

In the merchant service the stays are also fitted on the bight, or two in one, as follows: the bight is put over the mast-head, and both ends taken forward and set up in their respective places. Others again put the bight under the bowsprit and set them up abaft the mast-head, with lashing eyes, putting on a seizing at the proper place to form the collar. The last plan would not answer for a ship-of-war.

Size of lower stays:

1st rate fore and main, 2 of 12½ in.; mizzen, 1 of 9 in.

Forming Collars for Stays, Figs. 112 and 113, Plate 13. Another method is to proceed as in the foregoing, as far as turning back, when only one strand is laid back, and the other is used for worming; this makes each leg of the collar only three-stranded. Stick or worm the ends, parcel and cover with leather.

A third plan is to unlay the rope once the length of the mast-head, then take a strand of the same size as those of the stays; stick it two or three times below the crutch, and lay it in with one of the pair of strands, making it a three-stranded leg, the length of the mast-head; then form an eye in the end, and worm, parcel, and serve. Proceed in the same way with the other leg.

Still another method is to cut the stay once the length of the mast-head longer than the measurement requires, fit a flemish eye in each end, heave out the stay, and when well stretched, cut from one end a piece long enough to form the other leg of the collar, splice it in the stay at the proper place, and the collar is formed with two lashing eyes to go abaft the mast-head.

When hearts are used, they are turned into the lower stays, as the dead eyes in the shrouds, the end of the stay coming up under the standing part.

Fore-stay Straps, Fig. 288, Plate 38.* Although the method of reeving the stays through the bees, or through thimbles strapped on the bees, has almost entirely superseded every other, the old custom of rope straps is sometimes adhered to; and as cases frequently occur where the bees split, or become otherwise injured, the following is given in case of accident to the stays when fitted after the more recent method.

Take a piece of new rope (eight-inch for a frigate), stretch it well, and cut it in length *four* times the circumference of the bowsprit where it is intended to be placed, and *twice* that of the stay; get it on a stretch again, worm and cover it loosely with canvas; splice the ends together, and seize lock-thimbles (large enough to reeve the stay) in one of the bights, having the splice to lay in the score. The rope must be rove through the thimble *before* splicing.

Or thus: a warped or wire strap is fitted, and the heart placed in one bight with a temporary spun-yarn seizing to keep it in its place, the opposite bight of the strap is taken round under the bowsprit, brought up and lashed to the collar below the

* This figure shows the fore-stay *amidships*, whereas it should come a little on one side of the bowsprit, as in Fig. 290.

PLATE 39

Fig. 290

Fig. 291

Fig. 292

Fig. 293

Fig. 294

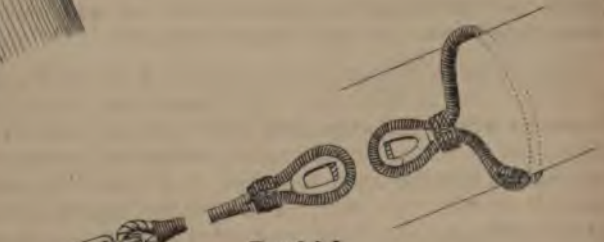


Fig. 295

heart, or a grommet is worked round the collar under the heart and the opposite bight is lashed to the grommet with a rose lashing. The heart is left at the side of the bowsprit, and has a large wooden chock to prevent its working round on to the top. Figs. 289 and 290, Plates 38 and 39.

When fitted in this way, the fore-stay collars are put on first counting from inside.

If Fitted Bale Sling-Fashion.* A long double strap, the heart being seized into the bight with a flat seizing on each side of the heart, and the eyes lashed together under the bowsprit with a rose lashing. The jib-boom passes through the collar between the heart and the bowsprit. Figs. 291 and 292, Plate 39.

When fitted in this way, the following will be the order of rigging.

Inner bobstay collars, first pair of shroud collars, inner fore-stay collar.

Middle bobstay collar, second pair of shroud collars, outer fore-stay collar. Outer bobstay collar, and cap bobstay. Fig. 305, Plate 42.

In point of looks, these straps are somewhat disadvantageous when compared with the late method of iron bands; and it should be borne in mind that the fore-stays, when reeving through the bees, require more length, and an additional allowance of the distance from the bolt in the bow, to the sheave in the bees, must be made.

The Main-Stays generally set up on their own parts to heavy iron thimbles, confined by iron straps made for the purpose, one being on each side of the foremast. The iron rods or straps lead down to the berth deck frequently, passing through the bitt-standards, and secure with a nut on the forward side. The main-stay is sometimes set up by screws similar to Fig. 287.

The lower end of the mizzen stay is forked to admit the main trysail mast, and each leg set up to an eye and thimble strapped to the main mast, on opposite sides.

Futtock Shrouds are always made of chain or iron rods. The upper end hooks to the futtock-plate under the top, and the lower end sets up to a jewsharp on the futtock-band, using either a laniard or a turn-buckle. In small ships they are rattled down. The chain of all futtock-shrouds to be proved. According to

* It must be borne in mind that rigging of this description is never to be met with in our service at the present day. These various plans of fitting rope rigging are given for the benefit of those who may have to rig a ship, where no iron work is to be had, and should be familiar to every naval officer.

Book of Allowances, they are to set up independently to the top-rim and not to plates of topmast dead-eyes.

Yard-Slings, Plate 32, are of chain, in length *twice* that of their respective mast-heads; to which must be added half the length of the forward lower cross-tree, that being the distance the yard should hang below the top.* The upper section, *i. e.* above the top, should be shackled together, keckled with a piece of large stuff to make it round, and neatly covered with canvas. The size of the chain necessarily depends on the weight it is required to support.

They should hook to the yard by a crane-hook, such as represented in Fig. 295, Plate 39.

Preventer Slings for topsail yards, used when preparing for action, are made of chain and go around the mast-head.

Topmast Shrouds should be cut the neat length from topmast-*head* to fid, and fitted in all respects like the lower-rigging, with the exception that the forward swifters are served all the way, (to avoid chafe from the topsail-yard), and sister blocks for the lifts are seized between the first and second shrouds, just clear of the bolsters; and *not* between the swifter and first shroud, as recommended in some books; as the pressure of the yard, in clewing down, on the lee side is apt to split the shell; care being taken to seize the one on the *port* side the *diameter of the rigging* further *below*, so that it may be in the same right line with the one on the starboard side. Fig. 296, Plate 40.

The size of rope for topmast rigging, varies much with the particular opinion the rigger may entertain with regard to its utility; for many seamen hold, that it is of little or no absolute service, except as a means of ascending and descending the masts. But the contrary of this estimate is satisfactorily exemplified in the fact, that where vessels have been obliged to lose their topmasts, it is *always* necessary to cut away the laniards of the shrouds, after the backstays have been severed, in order to get rid of the mast.

Topmast and Spring Stays. For length, take the distance from the after-part of their respective mast-heads, to where *they lead* and set up. They are fitted in all respects like the lower stays, being leathered in the wake of the bees, clump-blocks, or whatever they reeve through. It should be remarked, however, that this rule has regard to the diversity of manner in leading stays; some being brought to the deck (as in the case of those of the

* It will be observed that the suggestion offered under the head of MAST-PENDANTS, in reference to their length, has a direct relation to this point.

PLATE 40

Fig. 296

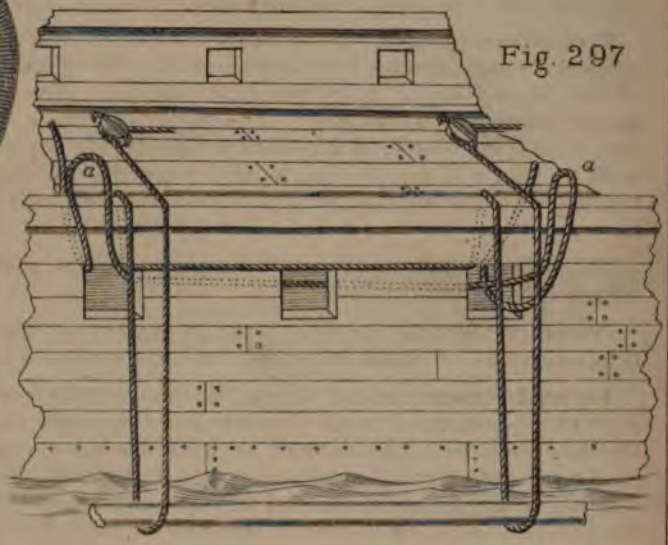


Fig. 297

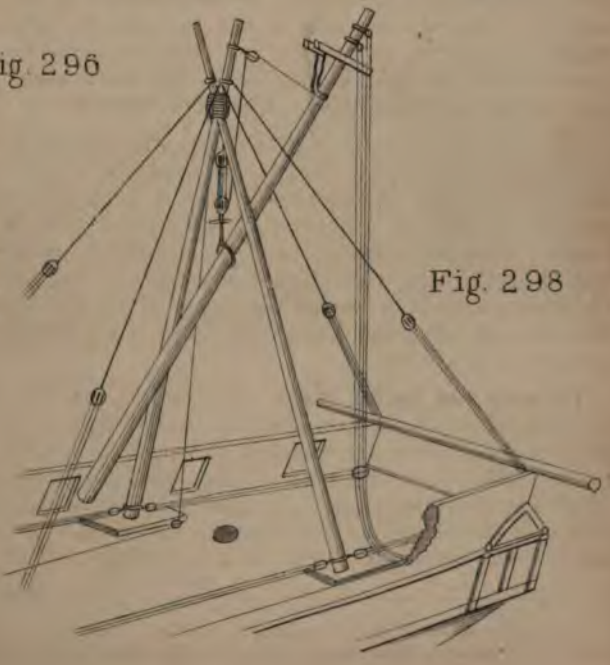


Fig. 298

main-topmast), while others are made to perform the service of bowsprit shrouds, &c. And again, in the merchant-vessels of the present day, they are sometimes fitted to go around the bowsprit, and cleated, like the lower stays, already mentioned. The best manner of leading them is to reeve the fore through the bees, and set them up to the bow—to bring *one* of the main to the deck, without regard to the foremast-head, and the mizzen to the main-top.* The usual plan for the main is to reeve them through sheaves in the after-chock of the fore tressle-trees, and set them up on deck at the fore partners.

Standing and Breast-Backstays† should be cut the neat length from the mast-head to their respective channels. The *standing* ones go over the mast-head like the shrouds, and are fitted in the same manner, being covered with raw-hide, or served in the wake of the tops and lower yards (when braced up). The *breast-backstays* are single, and fitted with a small neat eye, which is parcelled and marled over.‡ A good-sized double-block is spliced in the lower end for the fall to reeve through; the eye forming the strap of the block, should be made long enough to turn it out in case of necessity without drawing the splice, having a seizing close down to the block.

The breast-backstays should be covered, or served in the same manner as the standing ones.

Jib-Stay. Take the distance from the topmast-head, to where it leads and sets up, for the length. It is fitted either with a flemish eye in the upper end, and lashed to the collar of the topmast-stay, or with legs, to go abaft the mast-head, as in the case of the other stays. The latter method is preferable, however, for by lashing it to the topmast-stay, the entire weight and strain of *two* stays, one of which supporting a heavy sail, is brought upon *one* collar. In either case it is wormed and served, or leathered, a few feet below the crotch or lashing, to avoid chafe from the foot of the top-gallant sail. The other end is pointed, and a small becket worked in, to bend a *marrying line to.*

Top-gallant Rigging. The *shrouds* should be the neat length of their respective topmasts and top-gallant-masts, when set up in the top; otherwise the length of the top-gallant-masts only, in which case futtocks are dispensed with; they should be wormed, parcelled, and served in the wake of the cylinder, and below the futtock-staff, except the forward one, which should be

* The mizzen-topmast has no spring-stay.

† Breast-backstays are mentioned though their use has been given up for some years past.

‡ The best plan; as it admits of their being sent down in port.

served the whole length. They are made to extend entirely across, the starboard-forward and port-forward shroud being in one piece, and so on, and to fit so snugly as to require to be driven on the funnel. The eyes are formed by means of seizings on each side—a bull's eye or thimble being seized in between the first and second shrouds, just below, for the top-gallant lift.

The method given here of fitting top-gallant rigging brings all the strain upon the seizing. If that goes, while carrying a heavy press of canvas, the result may be imagined. This is an instance where security is sacrificed to what is called neatness, a principle which the generality of practical seamen are opposed to. The better way appears to be to fit the top-gallant shrouds in pairs like the lower shrouds, Fig. 326, Plate 48.

The *standing-backstays* are cut the neat length from the mast-head to the channels, and fitted with horseshoe eyes, Fig. 107, which are wormed, parcelled, and neatly covered with canvas. They should also be leathered, or served in the wake of the tops and lower yards, when braced up; and, in size, are somewhat larger than the shrouds.

The *breast-backstays** are the same length as the standing ones, and are fitted with a small eye in the upper end, which is marled over; the other has a single block turned in it, for the fall to reeve through. They are leathered or served in the wake of the tops; and in size they should correspond with the top-gallant shrouds.

The *fore* and *aft stays* (in length) should be cut the mean distance from the mast-head, to where they lead and set up, of the same sized rope as their respective breast-backstays, except the flying-jibstay, which is somewhat stouter. They are fitted with a neat, round eye, to go snugly over the cylinder, which is wormed and covered with canvas—needing no protection, on account of being put over *first*, except a few inches of parcelling and service, just below the splice of the eye.

The rule for the length, as stated above, is applicable to the various methods of leading the stays, as the stretching (if cut from the coil) allows for the eyes and ends. The *fore* reeves through the *outer* sheave in the jib-boom end; the *main*, through a sheave in the after chock of the fore-topmast cross-trees; and the *mizzen*, through a hole or roller in the after part of the main cap. The *flying-jibstay* is cut and fitted in the same manner as the fore-top-gallant stay, and leathered for a few feet below, to avoid chafe from the foot of the royal. The lower end should be pointed, and a neat becket worked in to bend a marrying-line to.

* No longer used in the service.

FITTING RIGGING.

Royal Rigging. The *shrouds*, which are single, lead into the top, and are cut the neat length from the hounds of the royal-masts to the topmast fid; leather them in the wake of the jacks, cross-trees, and futtock-staves, and turn small single blocks in the ends for gun-tackle purchases, which will save the necessity of breast-backstays.

The *backstays* are the neat length from the hounds of the royal-mast to the deck, and are fitted in one with the shroud; the eye (which is wormed, parcelled, and covered with canvas) is formed by seizing the shroud and backstay together on each side, and made to set snugly over the hounds, a small bull's-eye or thimble being seized between the two for the royal lift. The *fore-and-aft stays* should be in length the neat distance to where they lead and set up, fitted in all respects like the top-gallant stays, being leathered in the wake of sheaves, rollers, &c.

A funnel for the royal rigging, similar to that for the top-gallant, excluding the jacks, is now coming into use.*

Seizings—

Eye-seizing for	11-in.	rope,	21-thread;	quarter	do.,	15-thread.	
"	" 10	"	18	"	"	12	"
"	" 8½ to 8	"	15	"	"	9	"
"	" 7	"	12	"	"	6	"

NOTE.—It will be borne in mind, that the foregoing measurements, in all cases, suppose the masts to be fidded.

Bobstays, when of rope, are cut *twice* the length from their straps on the bowsprit, to the holes or shackles in the cutwater. They are wormed, parcelled, served, and leathered in the wake of the cutwater, and are fitted with a heart in the upper bight, which has the splice in the score, when rove. When chain is used instead of rope, they are only *once* the distance from the strap (or, in that case, *iron-band*) to the shackle, *minus* one circumference of the bowsprit, which allows for a *rope-laniard*, reeving through a heart, as in the method above. The heart is turned in with an eye-seizing, passed in the same manner as that referred to under the head of "LOWER RIGGING."

Collars for Bobstays are fitting as in Figs. 293 and 294, Plate 39. A, represents the bowsprit, and B, the hole in the cutwater.

Bowsprit Shrouds, were fitted formerly of rope and chain (half of each), and in length once the distance of their eye-bolts, in the bow, from the strap on the bowsprit. The rope part, fitted with a thimble in one end, is connected to the chain by means of

* An iron collar band with eyes is sometimes used, the royal rigging *hooking to it.*

a shackle; the other extremity is spliced around a heart, and goes with a laniard, as in the case of bobstays. The splice of the thimble and heart should be served.

There were two pairs of bowsprit shrouds, eight inches in size for a first-rate, decreasing half an inch for each succeeding size.

The bowsprit shrouds and bobstays are now invariably fitted of iron, with rope laniards.

In the after end of bowsprit shroud should be a chain slip, Fig. 295, Plate 39. The slip is secured to an eye-bolt in the bow, and enables the bowsprit shroud to be let go quickly when the bow-gun is fired.

Collars for Bowsprit Shrouds are fitted as in Fig. 295, and are secured underneath the bowsprit by a rose lashing.

NOTE. Care should be taken to exclude all service not absolutely essential to preservation of the bowsprit rigging, on account of its retention of water, and the consequent tendency to produce rot.

Jib Guys. The length of the fore guys, when fitted, from the crutch of one eye to that of the other, will be one foot less than the length of jib-boom from hounds to heel. If wire guys, the neat length of boom from hounds to heel.

Should the guy be fitted with an eye to go over the boom end it may be fitted thus: Whip the rope at twice and a half its circumference from the end. Take once the round of the jib-boom (where the eye is to fit), and once the round of the rope from the whipping to the strand where the marling-spike is first entered; put the strand in once whole strand and once half strand: set up and stretch the splice, marl the ends down and serve over to eighteen inches below the crutch.

The eye for the whisker may be fitted in the same manner, if the guys are fitted separately.

After Jib-Guys, same size as fore-guy.

In making the drawings of masts and spars, allow the whiskers, Fig. 276, Plate, 34, to incline a little forward; then measure from the hounds of the whisker to the cat-head, adding to that length sufficient to make the eye, which would be once the round of the spar and rope, with enough end for splicing. Then the length required for turning in the thimble will give enough drift for setting up with a laniard, or enough may be allowed for setting up to its own part through a bulls-eye.

After the bowsprit is in, to measure for the after guys, take a *line athwart* the deck from one cat-head to the other, and haul it

well taut; then measure from that line to where the whisker hooks on the bowsprit, and you will get the length of the guy from eye to thimble.

The jib-guys, instead of being fitted in two separate pieces (forward and after), are frequently cut in one piece; then splice the two ends of a short piece of rope in the proper place on the guy (found by measuring), to form an eye to fit over the whisker.

The flying jib-guys may be fitted to go over the boom-end in the same way.

The net under the jib-boom is to be made of ratline stuff, meshes seven inches and of a diamond shape, lacing to the jib-guys.—(Book of Allowances.)

Martingale-Stay. The length of the martingale-stay, from eye to eye, would be seven eighths the length of the jib-boom, from hound to heel.

If a wire stay, allow six inches longer. Then, from the hounds of the jib-boom to the hounds of the dolphin-striker, allowing it to incline forward, will be the length from the fork of one eye to the fork of the other. Splice an eye in each end; set it up; stretch the splices and worm it from end to end with $1\frac{1}{4}$-inch rope, or smaller, in proportion to the size; marl the ends down and serve over.

If the stay is of wire, it should be wormed, parcelled, red-leaded and served, from end to end, and the eyes served before splicing.

The Book of Allowances requires the martingale-stay to be of chain.

Martingale Backropes, called formerly *gaub* or *gob*-ropes, are fitted to go round the dolphin-striker with a cuckold-neck, and set up to their own parts, through bulls-eyes strapped with iron to the bows.

For a first rate, they are in size five inches, decreasing one half an inch for each succeeding size.

They are frequently made of chain.

The JUMPERS for the whiskers, should be $4\frac{1}{4}$-inch for first rates, decreasing as before. (See Whiskers.)

In a review of the *approximate* rules here given, it will appear that many of them are so general, as to lack that dependence in accuracy which strict economy demands. But it must be remembered that the opinions of seamen in reference to rigging are so various that the system of each would require some

GENERAL REMARKS.

special rule. Under these circumstances, no invariable one, which will stand the test of universal application, beyond a mere "rule of thumb," can be substituted for the proper measurement of drafts. Recourse ought, therefore, *always* to be had to the most accurate means; and no ship is complete in her outfit, which is permitted to sail without a draft of her spars and rig ging.

WIRE RIGGING.

Cutting out Wire Rigging. Wire rigging is cut on the straight, and never warped around pins or Sampson posts, as is sometimes done with hemp rigging. Having secured one end, clap a stout luff on the other, beyond the mark for cutting, on both sides of which put a good whipping. When straight along the floor of the rigging loft or deck, lay an axe under the wire at the mark, and beat it down with a commander. Or, in cutting out shrouds, having secured one end, lead the wire through a snatch block, lashed at a point from the end equal to the length of a shroud leg, bring the other end back, and clap on the luff as before. When both parts are straight along the deck, cut at the chalk marks on the deck, having put on whippings, and mark the bight with spun yarn and one knot, reeve and cut the second pair, marking with two knots, &c.

In Splicing Wire, stick once, whole strand; once, two thirds strand; and once, one third of a strand, which will make a good taper; get it on a good stretch, break the yarns close off to the rope, by working them backward and forward two or three times quickly, and parcel and serve over the splice with spun yarn; also serve over a sufficient length for the eyes before splicing them. Wire stays are served the same as hemp, and fitted the same, except the lashing eyes, which are spliced; but in cutting stays, the half collar and sufficient end for splicing must be allowed for, as there is little or no stretch in wire rigging; the shrouds are parcelled and served all over, otherwise the ratlings would slip down from their places. Care must be taken in turning in a dead-eye, that it is done properly, as in the event of a change becoming necessary, it is difficult to get the old nip out of the wire.

The rule has been to allow six inches to a fathom for the stretch of hemp rigging, but in cutting and fitting wire it should be remembered that the neat length is required, and no allowance for stretch.

Wire rigging is fitted as follows: After thoroughly stretching the rope, give it a good coating of red-lead paint, mixed with the

best boiled linseed oil, and of such a consistency as not to drop off during the operation. Then worm and parcel throughout, the parcelling to be coated with red-lead paint, which in this instance is somewhat thinner than before, on account of the absorption by the parcelling. To allow the oil to coat, it is better to let the rigging stand twenty-four hours after the latter operation, when serve with roundline, hambroline, or well-tarred spun yarn, according to the nature of the work to be done. Two-yarn spun yarn makes the best work, and the tar from it mixing with the red lead, makes an impervious cement, and thoroughly protects the rope. Roundline makes the neatest job. In other processes the acid from the tar eats into the wire.

All wire rigging in our navy is to be set up with hemp laniards, which will impart all the "give" necessary.

It is not unlikely that ere long all our ships will be fitted with this kind of rigging, and that the use of hemp for standing rigging will be exceptional.

Wire Shrouds. The eye is made five-square, fitted as above, and has a seizing similar to the hemp shroud. They are parcelled and served throughout their length, both for preservation and to prevent the ratlines slipping; have the patent dead-eye and hemp laniards.

Wire Stays. To form the collar, open out the rope into two legs of three strands each, a little over the length of the collar, say 12 feet; an additional piece of 12 feet is then cut, and from it taken 4 strands, 2 for each leg. These are laid up in the vacant lays, making each leg five-stranded; a lashing eye is spliced into the end of each leg, and the four ends stuck at the crotch, as in a hemp collar. This makes a beautiful collar.

Thimbles may be very neatly spliced in as follows; Red lead, parcel and serve the rope, as before, the neat length of the round of thimble. Break the rope around the thimble and put it in a bench screw; stop it together and put seizings through the thimble and around the rope on each quarter, then open out and splice, passing each single wire separately.

Besides the marling-spike, pincers, files, and cold chisels, are used in the manipulation of wire rope.

Mastheads for wire rigging should be *round* and encased by composition cylinders, fitted in two equal parts.*

* For much of the information in regard to the fitting of wire rigging, the compiler has to thank Mr. Thos. G. Bell, Boatswain, U. S. N.

CHAPTER IX.

MASTING.

In fitting out our men-of-war, advantage is taken of every facility which a navy-yard affords. The rigging is cut out by the draught furnished by the constructors, using the Book of Allowances as a general guide. The masts are placed by the navy-yard sheers, and the holds stowed by regular stevedores. But in the following general outline of masting and rigging, the conveniences of a yard are dispensed with. The vessel—a frigate—is supposed to be lying in the stream, and her spars, rigging, and stores, to be towed alongside and brought off in lighters.

This particular case is selected, supposing it to be the most primitive, in order to impart a general idea of the method of masting and fitting out with one's own resources, leaving it to the intelligence of the officer to avail himself of any facilities which may offer in actual practice.

When navy-yard sheers are used, the mast is brought down from the spar shed and placed with its head out (toward the ship), under the sheers or masting derrick, the garland lashed on and the main purchase toggled, the fall being brought to a *crab* or capstan, built for the purpose. Convenience alone determines, in this case, which mast is to be taken in first. After placing one mast, the ship is either hauled ahead or dropped astern, to bring the other partners plumb under the purchase.

Kentledge. One of the first steps toward masting is, to stow the kentledge, in order to give the hull stability; the method of doing this will be given under the head of stowage.

Next proceed to support the spar-deck for the great weight it will have to sustain, by *shoring** it up fore-and-aft, particularly those beams immediately under the places to be occupied by the sheers when getting in the masts.

Sling skids outside, leading from the gunwale to the channels, and from the channels to the water's edge; lash a half-rounded

* *Shores* are stout pieces of timber or joist, placed under a beam and resting on a *block*. To give the deck above a proper support, they must be wedged up.

spar on the top of the gunwale, the upper surface being well slushed, to lead the parbuckle over, and proceed

To Reeve the Parkbuckle, Fig. 297, Plate 40. The main parbuckle consists of a hawser of a suitable size—say 5-inch—which is middled and the ends rove through the spar deck ports, a few ports apart (the distance depending on the length of the sheer legs), from *out, in,* leaving the bight outside. The sheer legs having been towed alongside, with their heads aft, pass the after end of the parbuckle down under the head of the first sheer leg, up over the gunwale to the opposite water-ways, where the end is snatched and led forward having a long luff clapped on it, if found necessary. The forward end of the parbuckle is led in like manner, taking it under the heel of the sheer leg and thence to the capstan.

The Counter Parbuckles, *a a* Fig. 297, are rove in a contrary way, for easing the sheer legs inboard. They are rove through the same ports, from in, out, leaving the centre bight inboard, and the two end bights hanging down inside to catch the sheer leg when it comes over the gunwale; the ends are led down through the gun deck ports and taken around spars lashed fore and aft in the ports, having hands to attend them to ease the sheer legs down. Have a stout spar laid across the gunwale well aft, to rest the heads of the sheer legs on when on board.

When ready, clap on the luff, man the bars, and "*walk away.*" When "high enough," or up with the gunwale, "*avast heaving,*" arrange the counter parbuckles under head and heel, and set taut. Now pull up on the main, and ease away on the counter parbuckle, land the heel on the deck, the head resting on the thwartship spar placed for the purpose, roll it over, lift the heel over the capstan and get it in its proper position for forming the sheers; a spar may be placed from the gunwale to the capstan, and the sheer leg got thence to the opposite water-ways. The second sheer leg is got on board in the same manner, and placed for lashing.

NOTE. Instead of using parbuckles, the sheer legs may be got on board by means of a pair of small sheers, raked over the taffrail.

Fore and main topmasts may be used for sheer legs, or lower yards; in the latter case, the yard-arms must be well strengthened, or *fished* and *woolded,* by lashing around them small spars, or *made fishes* of stout oak plank, using well-stretched rope, and tautening the lashings by wedges. The lashing around the spar is termed a *woolding.*

MASTING.

The Sheers.* The sheer legs being on board, cross their heads, square the heels and spread them about two thirds the breadth of beam at the mizzen partners, so that when spread out to their full extent, the sheer head lashings may be tautened.

For sheer head lashings, take a piece of good 3½ or 4-inch rope, well stretched, middle it and make one end fast to the sheer leg, near the cross; with the other end pass the requisite number of figure-of-eight turns round both spars and take a couple of half-hitches with the end around one leg. With the first end, pass a number of round turns, filling up the intervals between the figure-of-eight turns, pass frapping, or cross turns, and secure the two ends with a square knot. After the heels have been spread, the sheer head lashing may be made more secure by wedging.

After passing the sheer head lashing, spread the heels and place them in the shoes. The shoes should be of stout oak plank, long enough to rest upon at least two of the spar deck beams. A saucer, is cut out of the centre to rest the heel in, and on the forward and after side an eye-bolt is placed for lashing the heel to. There are eye-bolts in the forward and after ends, for hooking fore and aft *shoe-tackles* to, to aid in the transportation of the sheers. Lash the heel to the shoe temporarily. Hook the after heel tackles to straps around the heels and set them taut, and, as an additional security, when raising the sheers, shift the forward heel tackles aft.

The Main Purchase. Lash on the upper block of the main purchase, so that it will hang directly under the cross. It should be a large threefold block, double-strapped and fitted with a long and a short leg, the former passing over the sheer head lashing, reeving through the eye of the latter, and is hitched around each sheer head and the ends stopped down with spun-yarn; or the strap may be fitted with two short eyes, connecting them by a lashing passing over the cross of the sheer head.

The straps of the main purchase blocks should be well parcelled and marled. The lower block is double-strapped, with eyes for toggling, Fig. 235, Plate 27. Take the lower block of the main purchase to the bowsprit hole, and toggle it there with a suitable spar.

The fall should be new 5½-in. Manilla rope. Begin with the standing part and reeve it from *forward, aft*, through the side

* In the figures representing the sheers, there are several items omitted to avoid confusion. Nor are they rigged in the figure precisely in accordance with the description given in the text. But the illustration will serve to convey a general idea of their appearance.

sheave of the upper block, beginning on the side opposite to that intended for taking in the masts; thence through the corresponding sheave in the lower block, and so on until rove full, when clove hitch it around one of the forks close to the lashing, and stop the end down to its own part. Snatch the fall in some convenient place near where the lower block has been toggled, and take it to the capstan.

If apprehensive that the upper purchase block will slew in its strap, by the greatest strain coming on one side, the fall may be rove so as to lead from the centre sheave—but this brings a turn in the fall, and is, therefore, objectionable.

The Small Purchase, Guys, &c. The upper block of the small purchase is double, and lashes to the after fork so as to play clear of the main purchase. Lash a single block to each fork above the small purchase and reeve stout girtlines. For sheer head guys, clove-hitch a couple of stout hawsers over the sheer head, leading two ends forward and two aft, and to each clap on a luff-upon-luff for convenience in setting up and easing off, without surging. Belly guys are put on in the same way, about one third the distance down each leg, cleating the hitches to prevent slipping, and clapping on luffs. On each sheer leg just above the shoe, put good straps, and hook and set well taut a thwartship tackle to ease the strain on the water-ways; lastly, pass a bulwark lashing either to the bulwark or to a stout toggle placed outside of the spar-deck ports.

Raising the Sheers. The main purchase fall, being led to the capstan, the heels temporarily lashed to the shoes, and the forward and after-shoe and heel tackles, both hooked aft, to prevent the sheers from launching forward as the strain is brought on the main purchase; the thwartship heel tackle set well taut, and plenty of hands to take in the slack of forward guys, and others to attend after ones, man the capstan, and heave around, catching the sheers as they rise by the thwartship spar.

When nearly up and down, or at an angle of about eighty degrees with the spar deck, "avast heaving," lash the heels in the shoes securely, shift the forward heel and shoe tackles, cast off the bulwark lashings, and transport the sheers to just *forward* of the mizzen partners (having previously wet the deck), by moving one leg at a time. The sheers should have a slight rake aft, and the main purchase hang plumb with the mast-hole. The fall may lead through a block toggled through the ward-room sky-light and thence to the capstan. When the sheers are in position, set up the after head and belly guys leading to the quarters; and the forward ones, leading well forward; set taut the thwartship tackle, and pass the bulwark lashings of good

stout rope—the main object of which is to prevent the opposite heel from rising when raising the mast from the water. Now overhaul down outside the main purchase and toggle to the garland on the mizzen-mast.

The Derrick. It may occur that the angle of the sheers with the deck, before raising, is so small that the main purchase will not be effective, in which case it will be necessary to start them up with a derrick, as follows:

Place a spar of sufficient size—about two thirds the size of a sheer leg—on the deck, with the heel, or larger end aft, toward the sheer head, and a little abaft the sheer heel. Connect the heel of this spar with the heels of the sheers by means of stout tackles, so that it will be equi-distant from each, and place a shoe under its heel like those used for the sheers. From the head of the derrick, have guys of equal lengths, leading one on each side, well secured and of such lengths as to permit the spar to rise to an angle of about seventy degrees with the deck.

Bring the lower block of the small purchase around the cross of the sheers, and secure it to the forward end or head of the derrick, the fall leading forward. When ready, man the small purchase, and have hands to take in the slack of the main purchase—"sway away"—the light spar will rise, the heel being steadied by tackles. When up to about the angle of seventy degrees, the guys will tauten and the spar cease to rise, the purchase will then act upon the sheers at a good angle, and the sheers will begin to rise; take in the slack of the main purchase, and as soon as it will act make use of it and get the derrick out of the way. Or, by a second method—a small stout spar (say a stump top-gallant mast) might be employed between the cross of the sheer-forks, where it could be retained by a loose lashing. Hook a stout tackle from the head of this spar to the sheers, and attach two other (canting and heel) jiggers together with head-guys, as in Fig. 299, Plate 41. With these, get it erect, slushing the spar and the forks at their points of contact. Now, with the assistance of the tackle, the head of the sheers can be elevated to a considerable degree, and the main purchase made to act, at an angle sufficiently great, to raise the sheers without further difficulty.

Getting in the Lower Masts. The mizzen mast is taken in first because the breadth of beam is less aft, and the sheers, as they are transported forward spread the heels and tauten the sheer head lashings; and for the reason, that getting in the foremast last, the sheers may be better secured and raked for getting in the bowsprit.

PLATE 41

Fig. 299

Fig. 300

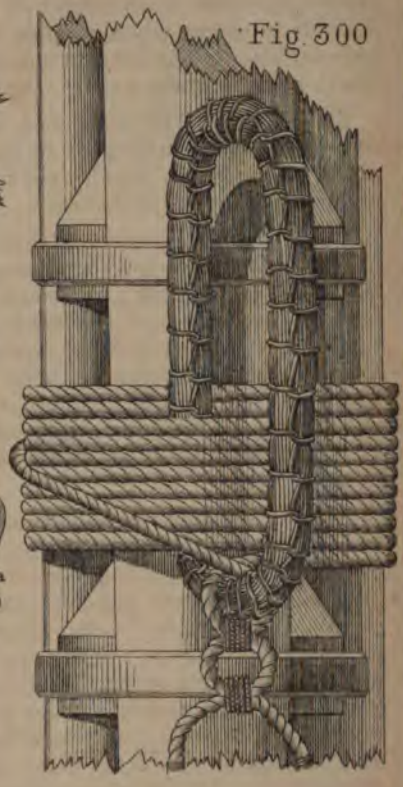


Fig. 301

Fig. 302

Fig. 303

Fig. 304

MASTING.

The Garland, Fig. 300, Plate 41, should be of good four-inch rope and made selvagee fashion, marling it with small stuff. It is lashed on with well-stretched rope, on the forward part of the mast, about six tenths from the tenon, or so as to allow it to hang a little heel heavy, taking the precaution, however, to lay off on the mast from the heel towards the head, a distance equal to the measure from the step to the spar deck partners, so that in lowering, the garland may not take in the partners before the heel is landed. The lashing should cross in the garland, and each turn as it is passed be hove well taut, or it may be passed as in the Fig. 300. After passing a sufficient number of turns, dog the ends down the mast towards the heel, as an additional security against slipping. The garland should be lashed on before the mast is put in the water, not only for the greater convenience, but the subsequent wetting tautens the lashings very considerably. If the small purchase is used—as in getting in the main and foremasts, its garland is placed on the mast as far above the main garland, as the small purchase block is lashed on above the main.

To take in the Mizzen-Mast, Fig. 298, Plate 40. Tow the mizzen-mast alongside with the head aft. Having overhauled down the main purchase abaft, shove the two eyes of the lower block strap through the garland and toggle it, using a small lashing to guard against slipping.

Man the capstan and "heave around," observing that the skids and mats, or whatever has been placed to protect the ship's side from chafing, are properly adjusted. When the mast head is up with the gunwale, "avast heaving," lash a couple of stout single blocks to the tenon, one on each side, and reeve girtlines, taking the precaution to knot the ends together to prevent unreeving. Put a couple of good straps around the mast, just above the futtock band, for pendant tackles, and bend the canting girtline, from the sheer head to the mast, just below the bibbs; sway up again until high enough; ease the heel inboard by a jigger, coming up the belly guy, which must be set up again. Pull upon the canting line and point the mast fair for stepping, wipe the heel dry, and white-lead the tenon and mortise, have hands on the gun-deck to keep the mast on the right slue, and carpenters on the berth-deck to attend at the step, lower away and step the mast. Sway up three pendant tackles and hook them to the straps about the mast-head—the two at the side set up in the channels, and one fore and aft to act as a stay; set taut the tackles and wedge the masts temporarily. When nearly stepped, a stout strap and heaver may be used to get the mast on the right slue.

MASTING.

Come up the purchases and take off the garlands. Cast off the bulwark lashing, man the guys, shoe and heel tackles, and transport the sheers, one leg at a time, observing to wet the decks and come up the thwartship tackle in the wake of obstructions; get them a little forward of the main partners, rake and secure them as before.

If the sheers are high enough or can be made available by spanning the fork above the sheer head lashing, send up the tressle-trees, &c., of each mast, before transporting them to take in the rest.

Take the main and foremast in, in the same manner, with the additional use of the small purchase.

Should the sheers prove too short, the fork above the lashing may be spanned by a stout rope and the upper block of the small purchase lashed to the span. If the garland *takes* in the partners before the mast is stepped, the heel may be rested on blocks, or stout planks, the mast steadied by the guys and the garland shifted higher. Or the garland may be dispensed with, and the strap of the purchase block lashed to the mast. Should the sheer legs be found too slender and to complain, a spar may be lashed across from one to the other, in the wake of the guys.

As a diversity of opinion appears to prevail among seamen, as to the particular construction and positions of garlands, it is thought proper to add a few words in reference to this subject. Garlands (represented in Fig. 301, Plate 41), as employed on board of the French line-of-battle ship "*Hercule*," in taking out an injured main-mast, were formed of small stuff (well stretched), and passed around two posts, at a distance apart, and size, depending on the conditions of the case; the ends knotted, and the whole hitched over like a selvagee. The garland thus made, was placed on the *forward side* of the new mast *before launching*, at the distance of the *top of the gunwale*, to *the step in the kelson*, laid off *from* the *heel* towards the *head*. It was then secured to the mast by a cross-lashing as in the figure, and the ends dogged, while a toggle was placed in the lower bight of the garland to prevent its rendering.

When both purchases are employed, as in the case above, in getting in heavy masts, a good plan, and one which obviates the necessity of heavers on the heel, is to lash the garlands, a little on each side, and *not* in the same right line with the axis of the mast (*a* and *b*). Then, by slacking one purchase and holding on the other, it may be slued at pleasure. The position of the small garland should be at the distance of *its purchase block*, *from*

that of the large one, on the sheers, above the main, so that the falls cannot come two blocks except at the same time.

As each mast is placed it is steadied by the pendant tackles and wedged temporarily.

To get in the Bowsprit. Transport the sheers as far forward as the bows will permit; send a hand to the sheer head, bend a girtline to the small purchase block and light it up; unlash and shift it to the forward side of the sheer head. Pass a strap around the foremast head, to which hook the double block of a large tackle; the other block take aft and set well taut. Lash a couple of large blocks to the foremast head; middle a hawser and clove-hitch it around the sheer head, reeve the ends through the blocks at the foremast head, lead them aft and set them up; take aft the forward head guys, which with the after ones, are to be set up, and the forward belly guys to the cat-head; hook the after shoe and heel tackles forward and set them taut. Rake the sheers over the bows so that the main purchase will hang directly over the gammoning scuttle, and make all fast; freshen the shoe lashing and pass a bulwark lashing.

The bowsprit is towed under the bows, with the head forward, the cap on, and the main garland lashed on a little over one third its length out from the heel, or so that it will hang head heavy. The small garland, lash on just inside of the cap. The double blocks of breasting tackles are hooked to eye-bolts in the cap, the single ones to the cat-heads, and a strap put around the heel for the bedding tackle, which leads from the bitts on the gun-deck, out through the bowsprit partners.

Sway away on the main and small purchases, steadying the spar by the guys. When the heel is high enough, hook the bedding tackle. Wipe the tenon dry, and white-lead it and the mortise. Keep fast the small purchase; ease away on the main and bowse on the bedding tackle and cat-head guys, and get the bowsprit in its place. Come up the purchases and guys, and unlash the garlands.

The bowsprit rests on the stem head, between the knight-heads and steps in the bowsprit partners—on the gun-deck in a frigate and on the spar-deck in a sloop-of-war. It comes inboard about one third its length. If the cap was not on, it may be shipped by means of a small pair of sheers, stepped on the bees.

If, by taking the forward head guys well aft, and setting them up, the support is found sufficient, the hawser at the sheer head may be dispensed with.

MASTING.

It may occur, by reason of the tide sweeping the heel of the bowsprit aft, and the position of the fore-tack bumpkin, that the main purchase might lead better if overhauled down *abaft* the bumpkin, than forward of it; though such is not likely to be the case with our modern vessels.

To Dismantle the Sheers. Proceed now to dismantle the sheers. Take the after heel tackles aft, come up the bulwark lashing, and rouse the heels aft, easing away the forward heel tackles, the head guys and the hawser, and lower away until the sheer head rests on the knight-heads; strip the sheer legs, cast off the sheer head lashing and get each leg aft in the gangway; unreeve the hawser from the fore-mast head and send down the single blocks. Put straps on the ends of the sheer legs and hook the fore and main pendant tackles to them, having the opposite tackles set well taut. Hook to the same straps, jiggers leading in from the channels. Pull upon the tackles, rouse out by the jiggers and lower the sheer leg overboard, taking care to have skids in the proper places to prevent chafe, and the spars taking against the dead-eyes in the channels. Or, the sheer legs may be got overboard by means of parbuckles, rove as counter parbuckles; but instead of taking the hauling part outside, hook the pendant tackles to them, sway up and launch the sheer leg overboard. Or, they may be got down by lashing their heads separately to the lower mast, casting off the cross lashing and lowering them by means of the pendant tackles.

In masting or dismasting with one's own resources, it is necessary, to measure the lengths for slinging the masts very accurately, so as to make sure of carrying the heel clear of the upper deck, and yet avoid, if possible, top-heaviness. When the spars are short for the work (as in the case of the topmasts of a high ship), the masts must be slung so low as to make top-heaviness unavoidable. In going out, when the heel of the mast is near the upper-deck partners, tackles are put on above from each side of the upper-deck, and particularly strong and long one, led from below through the lower mast holes, is lashed to the heel, and well cleated each way. The tackles are tautened, until when, the heel being clear of the partners, they are eased away, and the mast lowered head foremast overboard, Fig. 302.

In coming in, the mast is slung above the balancing point and hoisted with an extra tackle alongside the sheers; the purchases are then lashed low enough down, and the heel is confined to the side by the turns of a greased hawser passed through the ports; or, in a merchant ship, through the ballast-hole. When the heel is nearly up to the highest bight, deck-tackles are lashed on from all sides, which are cleated in their place. These are tautened

as the mast rises, and guy the heel, when high enough, into the mast-hole, Fig. 302.

In handling a *Bowsprit* with our own resources, Fig. 303, the fore-top-mast is of course struck, and the fore-mast secured with runners and tackles. Hang the heel of the topmast with a hawser, and unreeve the ends of the pendants from the topmast; unhook the top tackles, send the eyes of the pendants down abaft the top, hook on the top tackles, carry them aft, and lash the lower blocks to the skids; if not long enough, tail the falls with the main ones. Place the spare fore and main-top masts with heads across the forecastle netting, and lash them together, their heels being on each side of the fore-mast: on the upper side of these mast heads, lash the two main-top blocks, and on the lower, a threefold purchase block. Send the points of the fore-top-pendants down *over* the fore-top, reeve them through the top blocks on the spars, and make the ends fast to the fore-mast head.* Reeve a fall through the purchase block; upright the spars with the long tackles, led from the fore-mast pendants; secure the heels to the side; shore the deck underneath; lash well from forward; droop with the top tackles, until the heads overlook as far from the fore side of the hole as the length of howsing; lash the lower purchase block a little more than half way out on the bowsprit, and put a long tackle from the sheer heads to the bowsprit cap. Let the bowsprit come up, or hang athwart ships when suspended, so as to clear the figure-head; top or lower, to liking, with the top tackles. The purchase fall should lead to the deck in a line with the sheers.

A neat performance in the history of *Masting* on one's own resources was in the case of an English line-of-battle ship, which, having lost her own main-mast, helped herself in one operation to that of a captured frigate. Sheers were formed of the main top-masts, whose heads were supported by guys set up to the fore top-masts which were rigged out through the main deck ports on the off-side. A derrick was made of the main yard, which was secured at its lower quarter to the sheer leg on the working side, the pressure at this point being relieved by an athwart-ship spar, thrusting outward by means of a tackle led across the deck. The purchase on the upper arm of the derrick took the mast out, the frigate was dropped astern, the mast lowered until the sheer purchase "looked" well up and down, when that tackle brought it in.† Fig. 304, Plate 41.

* The pendants probably will not admit of being doubled until the sheers are raised by the long tackle.

† When in dismasting, a mast is jammed in the step, a gentle roll given to the ship will start it.

MASTING.

Besides carrying duplicates of all spars, except the lower ones, ships are supplied with wooden and iron Fishes. The former are nearly long enough to reach from the deck to the lower mast hounds; the latter are about 18 feet long, and are invaluable articles. There are also rough spars of different sizes, as well as spare anchor stocks, and large oak planks, all of which are available for jury rigging in emergency.

CHAPTER X.

RIGGING SHIP.*

WITHIN a few years, a complete change has taken place in the rigging of vessels-of-war; and to such an extent has the introduction of iron been carried, that the system may be said to have been entirely revolutionized. The substitution of iron for rope, in the fitting of yards and bowsprits particularly, has become so universal, that the rules are now quite distinct from the old plan. A written description of the iron-work now used on the principal spars of our ships, seems unnecessary. Plate 32 is designed to give the leading features and to render any further allusion to the subject superfluous. A comparison between the bowsprit in that plate and the one in Plate 42, will give an idea of the improvements effected in late years, in fitting out.

Whatever the advantages of iron, we propose here to show how *hemp* rigging is fitted, that it may be made available in cases of emergency, when iron work cannot be repaired or made.

Bowsprit. As the bowsprit is invariably rigged first, either for the purpose of getting it down in its place before gammoning, or because the staying of the fore-mast being dependent upon it would otherwise be delayed, it becomes necessary to prepare a stage under it for the men to stand on, which is rigged as follows: Secure the heads of two small spars (as top-gallant studding-sail booms, for example), together in a lashing hung from the bowsprit end, and rest the heels on the head-rail, where they should be seized, to prevent their slipping, and lay boards across from one boom to the other. If the forestays should *not* reeve through the bees, but be fitted with straps, then measure two thirds the length of the bowsprit *from* the knight-heads, *outboard*, for the point to put strap for the port stay.

Place the strap on the bowsprit, with the bight *uppermost*, in order that it shall not turn, while setting up the stay (which would be the case were reverse of the rule observed), and put the thimbles through the bight, if the strap in Fig. 288, Plate

* In the merchant service, ships are sometimes masted and rigged before launching.

38, is used, bringing them up again, so that those for the fore-stay shall be on the port, and those for the spring-stay on the starboard side; being careful that the parts do not ride on the bowsprit, and to place a seizing close down to the bights.

Next to this, put on the strap and *heart* for the inner-bobstay. Strap and *heart* for each bowsprit shroud, Fig. 289, Plate 38.

Once the diameter of the bowsprit further out, place the strap and thimbles for the spring-stay (fitted as in the other case).

Strap and *heart* for an outer bobstay.

Next, strap and thimbles, usually called "spectacles," for top-mast and spring-stays to lead through—if used as outer bow-sprit shrouds, otherwise a strap and heart for each of the latter.

Lastly, just outside the bees, place the strap and heart for cap-bobstay.

Reeve middle, and splice the bobstays, and seize in the hearts for a full-due at the splice (in the same manner as the eye-seizing passed on the shrouds of the lower rigging), having a strip of tarred canvas in the score, and stitching leather around in the wake of the cutwater. Splice the end of each bowsprit shroud around a heart, and reeve a few turns of the laniard (on the bight) to give the rigging a fit, and set up the bobstay and bow-sprit shrouds *temporarily*. Strap the fore and foretop-bowline blocks (the former to the fore-stay straps, the latter to eye-bolts in the bees), and proceed to gammon the bowsprit.

Though the description given in the text agrees with the general custom of the service, still the order of rigging on the bowsprit sometimes varies, as will be seen by Fig. 305, Plate 42. This figure also shows a different method of fitting collars for the forestays. The collars may be warped, or made of iron wire. They go with lashing eyes under the bowsprit.

When four bob-stays are used they are named as follows: Inner, outer, middle, and cap bobstays.

Gammoning. Although iron for gammoning has almost universally superseded rope, it is, nevertheless, liable to accident. The following method of passing it, when of rope, is that most approved of by experienced riggers:—Get a good strain on the end of the bowsprit, by suspending an anchor to it, or hooking a tackle to it and a scow, to seat it firmly in its bed, Fig. 306, Plate 43.*

* The gammoning in the figure is passed square, but the usual method is to pass it so that the *after turn on the bowsprit* will be the *forward one in the scuttle*, as in *Fig. 309, Plate 44.*

PLATE 42

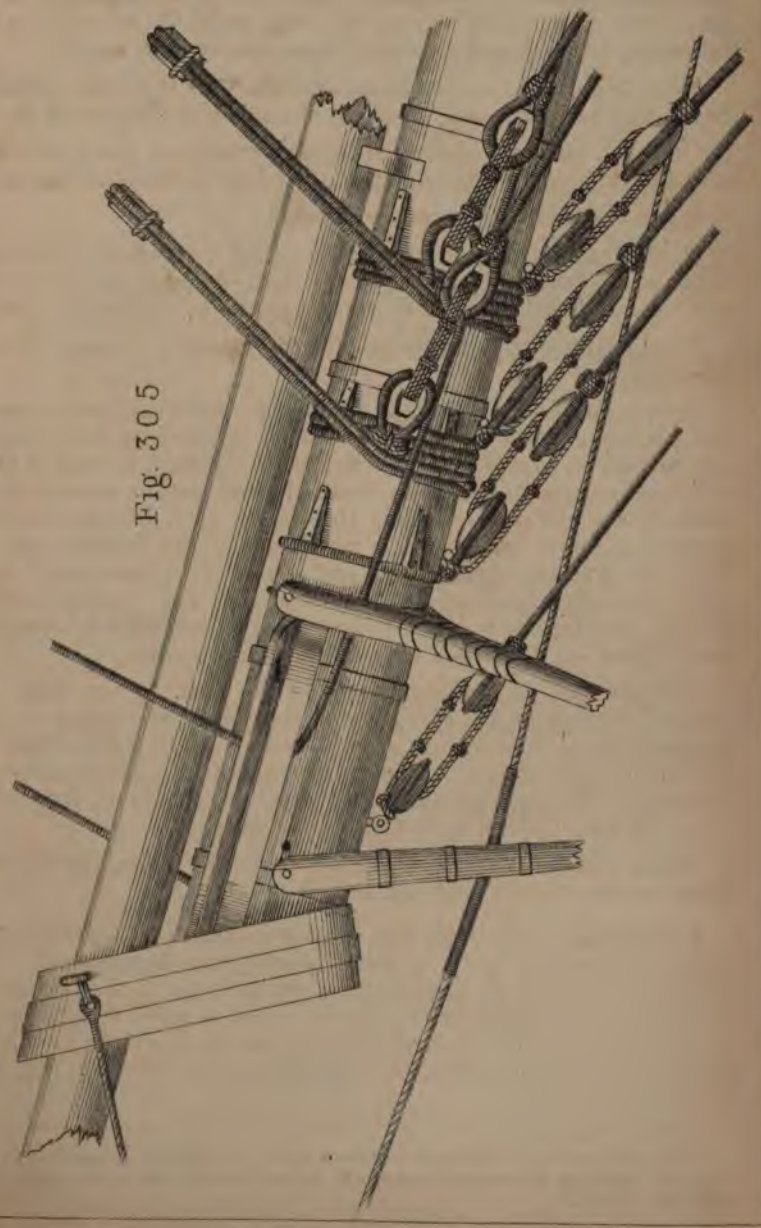


Fig. 305

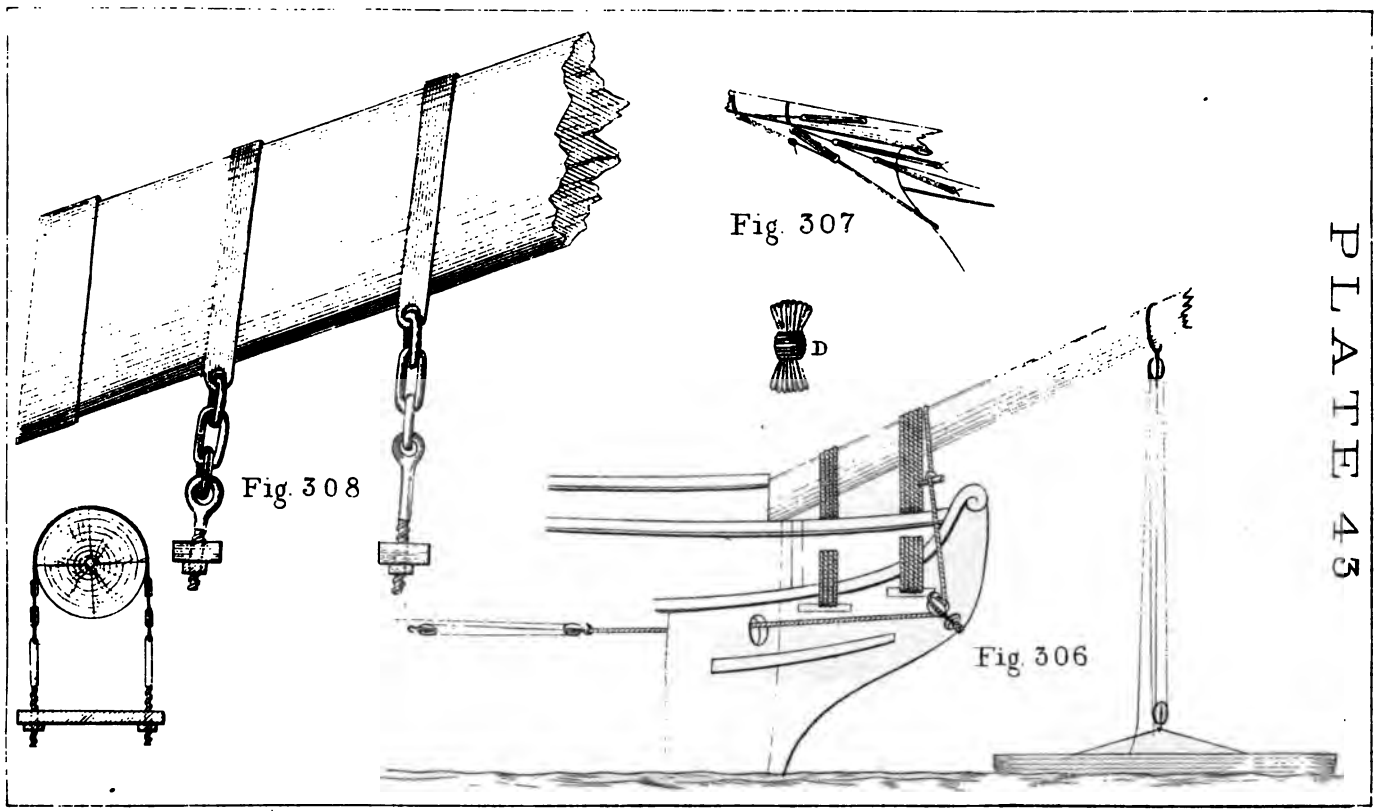


PLATE 43

Tar and leather the bowsprit in the wake of the gammoning, having the latter laid on the upper surface, sufficiently wide to come back and cover all the turns when passed; and place the bolsters (usually of soft wood, well protected with layers of parcelling) in the *upper* part of the scuttle. Take a piece of well-stretched *right-hand* rope (which is preferable to hawser-laid, on account of the tendency of the latter to stretch), and splice an eye in one end, and whip the other. Pass a turn of the gammoning around the bowsprit, *up* through the eye, over and down, cleating it abaft to prevent its slipping, and set it well taut with a luff and pendant, which is fitted with a hook and thimble at each extremity, and rove through a single block secured to the bobstay-holes in the cutwater, by means of a strap sufficiently long to allow the pendant to lead in a direct line through the hawse-hole, where a luff-tackle is clapped on, Fig. 306, Plate 43. Reeve a turn of the gammoning *against* the sun round the bowsprit and down through the scuttle; form a bight with the end; thrust in a toggle, and put a strap around both parts above the latter, to which hook the outer end of the pendant, setting it well taut, and racking each turn respectively. Pass the balance of them (usually seven), in the same manner, from *aft, forward*, until the scuttle is filled; then take the end *back*, between the bowsprit and gammoning, and *frap* all parts together with it, as at D, using jiggers from each fore-tack bumpkin. Secure the end by a seizing; cut the rackings (in order that each turn may share equally in the strain); haul over the leather (from *forward, aft*, that the inclination of the bowsprit may cause it to shed the spray), and tack it down. If double gammoning is required (as on board heavy ships), pass the *inner* in the same manner (since, if the *outer* turns were passed last, the inner ones would become slack), and set up the bobstays and bowsprit shrouds for a *full-due*, using a luff-upon-luff on *each* end of the laniard, Fig. 307, Plate 43. This is termed *reeving on the bight*, and the object of pulling on both ends at once is to prevent the heart from slueing.

Iron Gammoning. The most approved method of gammoning a bowsprit, at present, is by setting it up with a nut and screw, as in Fig. 308, Plate 43; another and very excellent method, which can be adopted in cases of emergency when iron work cannot be had, is by using a *chain*, as follows:—

The standing part is shackled round the bowsprit with a running eye, the end passed down, through the hole in the cutwater, up round the bowsprit outside of the standing part, and boused taut with a purchase, Fig. 309, Plate 44; whilst the next turn is being passed, the first is stoppered by driving large nails (which are not taken out again) through the links of the chain into the

gammoning fish on top of the bowsprit, and by racking it to the first part.

In passing the second turn, the end is passed down inside the first turn, crossing it from forwards aft, led through the hole in the cut-water abaft the first turn, up towards the bowsprit, being dipped inside the first part crossing it aft forward, then taken over the bowsprit outside the first turn, the purchase is then put on, boused taut, racked and nailed as before. The rest of the turns are passed the same as the second, being each boused taut separately, Fig. 311, Plate 44.

The last turn coming down from the bowsprit is secured with a strand to the others close down to the cutwater; the end is then frapped round all parts up towards the bowsprit, the last turn forming a figure-of-eight, and the end secured with a good spun-yarn, Fig. 312, Plate 44.

In consequence of the turns of the gammoning crossing each other, they close together on being hauled taut.

If the last turns of the gammoning were crossed outside the first turns, the gammoning would be equally as strong, but it would not form so snug a lashing.

NOTE. Of late, quite a number of merchant vessels have been fitted *without* gammoning, by giving additional strength to the step of the bowsprit. This, so far as *security* is concerned, has been found to answer all the conditions, and tend somewhat to vitiate the impressions formed with regard to the intensity of strain caused by the foremast. But in almost every case, there is a sacrifice of *length* in the bowsprit (compared with the old *régime*), which must contribute to affect materially the sailing capacities of a ship, by precluding that exposure of sail-surface forward, essential to rapidity of movement and ready obedience to the helm, besides imparting to a vessel a short and chubby appearance, far from pleasing to the eye of a seaman.

Rigging Lower Masts—Tressle-Trees. To send up the *lower tressle-trees*, send a couple of stout burtons to the mast-head, secured at each side, with the cheeks resting against the tenon, if you had not done so when getting the mast in.

Place the tressle-tree on deck, *forward* of the mast, Fig. 313, Plate 44, and take out the *after-chock*, as the forward one, by having to support the heel of the topmast, is more securely bolted, and consequently not designed to be removed. Hook the lower block of each burton to a strap around the *forward* horns, and stop the standing parts along to the after ones; white-lead the mast-head and tressle-trees in the wake of each other; bend on *a guy* from forward, sway aloft, and as the horns rise above the

PLATE 44

Fig. 309

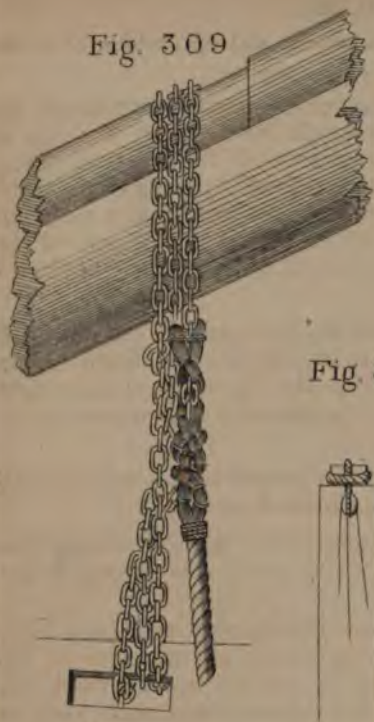
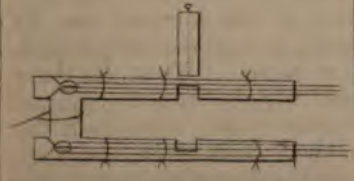


Fig. 310

Fig. 311

Fig. 313

Fig. 312



bibbs, cut the stops (a hand having been previously sent aloft), and work them into their places. Send up the after-chock and bolt it. Now place and *lash* (not nail) the bolsters, having them made of soft wood, and covered with three or four thicknesses of tarred parcelling. Tar the mast-head in the wake of the rigging, and get over the lower pendants, which are swayed up by the burtons, hooking in the pendant-tackles, and setting them taut to steady the mast until rigged.

This plan is preferable to that of spans, on account of its security, and the perfect command which the burtons, by being stopped down to the tressle-trees, afford. In the merchant service they are sent up by the sheers, after the stepping of the mast.

Another method of getting tressle-trees up, is by rigging a pair of derricks above the mast-head, lashed to the bibbs each side, and sending them up by burtons secured to their upper ends.

Whole Tops. Although half-tops have almost universally superseded the use of whole ones, except now and then in the merchant service, and the smaller classes of war-vessels, the following plan of getting them over, is that adopted by an old and experienced rigger.

Have two stout girtlines secured at the tenon of the mast-head, and a good-sized single, or double tackle, hooked to a strap in the central part and directly between the girtlines, as in Fig. 314,* Plate 45. Place the top on the deck *abaft* the mast, with the forward part uppermost. Overhaul down the girtlines and tackle; pass the ends of the former underneath the rim and make them fast to their own parts, around the after-part of the top, stopping them out to each girtline-hole, as in Fig. 314. Hook the lower block of the mast-head burton to a stout strap around the after-part (to which a guy is also attached, *leading aft*), and secure the *standing-parts* of the tackle and girtlines to the pigeon-hole by means of a squilgee-toggle, over which the bights are laid. Bend on a tripping-line to the toggle (which should be greased), man the burton and girtlines and sway away, pulling up steadily on all. When the forward rim comes up to the block, jerk on the tripping-line (which disconnects the parts, and permits the girtlines to go out to the side, and lead off fair); sway on the tackle until the lubbers-hole is clear of the mast-

* It will be observed that the figure is somewhat at variance with the description, by having the girtlines and tackle apparently on the *upper*, instead of the *under* side of the top; but this has been done designedly, that the reader might see the manner in which they were led and secured.

head, and lower away by means of the girtlines, sending it aft or forward with the tackle and guy as need be, having previously white-leaded the tressle-trees in the wake of the cross-trees, which are either secured to the top before sending it aloft, or sent up by means of the girtlines, first.

Bolt and secure the top with keys to the tressle-trees, ship the futtock and top-plates, stanchions, rail, etc., and send down the tackle and girtlines. It has been proposed to send two men up with the top, who hold the slip-ropes in their hands, and whose office it is to cut the stop at the pigeon-hole; but this method is objected to on the score of danger, and perhaps not without good reason. The plan usually resorted to is to send a man aloft beforehand, who cuts the stops; but even this, is liable to the same objection, and the first method is the best and safest.

One great advantage in using the burton, is, that when the rim of the top gets up to the tressle-trees and takes against them, then by pulling on the burton and slacking the girtlines, the upper rim is canted out clear and can be swayed up without further trouble.

To avoid catching under the tressle-trees, tops are sometimes swayed up on one side of the mast, to do which the opposite girtline is led *over* the tressle-trees down the proper side, and then both bent on as before, when the top can be swayed up without difficulty, cutting it round abaft as soon as clear of the tressle-trees.

Half-tops. Have two stout burtons at the mast-head (those used in getting up the tressle-trees), and hook them to a strap through one of the futtock-holes in each half, which must be placed on deck, with *outer* rims uppermost, at their respective sides of the mast. Sway the halves close up to the block at the mast-head and hang them there, until the cross-trees are sent aloft and bolted in their places. Then lower the halves down and secure them; sway up the upper cross-trees, and bolt and confine the whole with iron bands, sending down the burtons and girtlines, used to sway up the cross-trees. Fig. 315, Plate 45.

Lower-Rigging. As the routine of rigging is nearly identical on all the masts, the method of one, the *fore*, will answer for a description of the others, care being taken to note the peculiarities of each as they occur. In nearly all the works on seamanship, it is recommended to shift the girtlines from the mast-head to the after-part of the tressle-trees, for the purpose of sending the shrouds aloft. But in the merchant service, where economy of *time is* regarded, the topmast is pointed about four or five feet

PLATE 45

Fig. 316

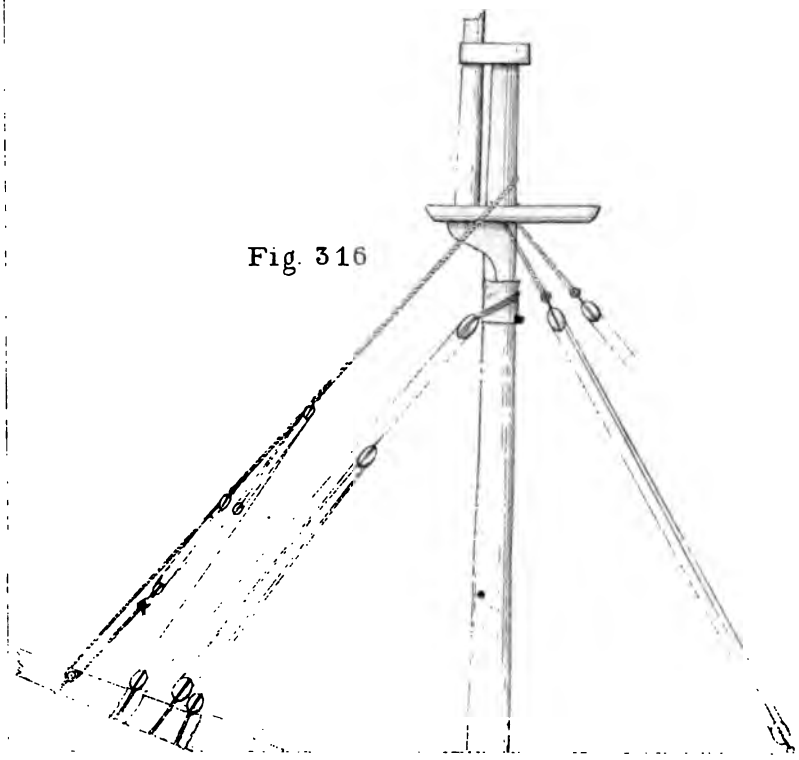


Fig. 314

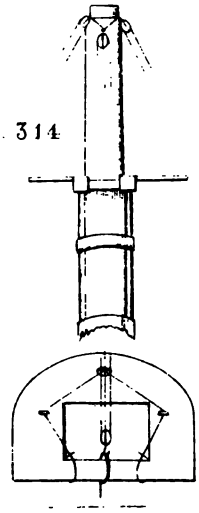
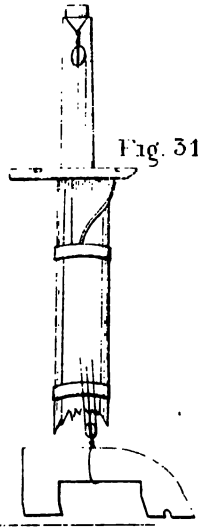


Fig. 315



above the lower mast-head, to which the eye-girtlines are attached, after the manner of a derrick.*

To Send up the Shrouds. In heavy ships, two girtlines will be required to support the weight of the shroud; the block of the main girtline, being toggled to the *midship girtline-hole* in the top, as out of the way, and more convenient, than when secured to the after-part of the tressle-trees as sometimes directed. The second, or mast-head girtline, being at the mast-head tenon and worked in the top. Send hands aloft with marline-spikes, tar, slush, commander,† etc. If the main-topmast and spring-stays are led into the top, in lieu of leading through sheaves in the after chock of the tressle-trees to the deck, place the straps, (fitted with clump-blocks, or thimbles and lashing-eyes, *to go forward*), over *first*, in order to raise the eye-seizings of the under shrouds, and to make them lay fair on the bolsters; the lower pendants having been placed, and *lashed* down (so as not to disturb the fit of the rigging), immediately after getting the tressle-trees aloft.

Now proceed to get the shrouds up, and over, in the order of their succession. *Knot* the ends of the main girtline together, and fit a toggle in one part, just above. Thrust this between the two parts of the first pair of starboard-forward-shrouds, from *out, in*, somewhat more than the length of the mast-head below the eye-seizing, and put a stop around both parts to retain the toggle in its place. Stop the girtline along the shroud towards the eye, and at the *crown*, and sway aloft. When as high as the top, bend on the small mast-head girtline just below the eye-seizing, taking the end from *in, out* (if mast-head girtlines are used, in lieu of one on the topmast as suggested), and stop it as in the other case. Cut the lower girtline adrift, as the shroud comes up, and steady it to the hand of the man aloft, who will bear the eye over the mast-head, and cast off the upper girtline Place it fair and *beat it down with the wooden commander*, being careful to carry the shroud well *aft*, as the angular action of the strain, in setting up, has a constant tendency to bring it forward.

Send the forward port pair up in same manner. Now rouse the legs of the shrouds well down *amidships*, i. e. in a line parallel with the mast, to give the eyes a good fit upon the bolsters, and set up all four legs at the same time by means of the pendant-tackles, so as to keep the mast upright, and the eye-seizings fair.

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* Should the topmast be pointed and hung by the two pendant tackles, this plan would be adopted.

† Commander; a large wooden maul.

RIGGING SHIP.

Too much care cannot be taken to get the eyes well down in their places at once. Slack rigging in heavy weather is frequently caused by the eyes "settling down" at the mast-head. It is also very important that the seizings should not ride.

To send up the Fore and Aft Stays. All the other shrouds are got over in the manner described above, starboard and port alternately, and set up temporarily like the first two pair. Shift the girtlines from the top, up to the mast-head, and lash them to the sides and well aft. Dip them down through the lubbers-hole, and bend the starboard one to the fore-stay below the crotch, stopping it to the starboard leg; bend the port girtline on in the same manner to the port leg, and sway aloft, cutting the seizings as the legs reach the top. Pass a few turns of the lashing (which is spliced into one of the eyes), and either rest the collar on the lower-rigging, or hang it in a lashing from the mast-head. Send up the spring-stay in a similar manner. Now reeve the ends of the stays through the bee-sheeves (or thimbles), and prepare for setting up.

It has been suggested that immediately succeeding the lower pendants, the *after-swifters* should be placed over, with the view of steadying the masts "gradually and accurately into their places," by means of them and the stays, "without wringing the eyes or seizings at the mast-head," but pendant tackles from the mast-head to eye-bolts in the deck, well aft, answer every purpose for getting the mast in its proper position, when the after-swifters being set up will retain it there, Fig. 316, Plate 45.

ON THE STANDING OF MASTS.

Experiment has satisfactorily proved, that by raking the masts *forward*, we increase the vessel's tendency to pitch, by changing the direction of the effort exerted by the wind on the sails, from a line parallel to one forming an oblique angle with the keel. This, of course, should be guarded against, as offering an impediment to the progressive movements of the ship, *not*, however, so much in diminishing the force of acceleration, as in augmenting the spaces over which she must pass, by causing vertical deflections from a horizontal course; besides increasing the difficulty of trimming the yards, in consequence of their confinement when *by*, the wind. Indeed, the sole advantage of inclining the masts forward, consists in producing a readiness to *wear*, which, however, is always attended with a corresponding indisposition in coming to, and the obvious necessity of lee helm, to make the vessel keep to the wind. In the ordinary evolutions at sea, these *objection*able causes are not always self-evident, in consequence

of producing effects which are correspondingly imperceptible. But in case of emergency, as in scudding (where the remedy is precluded), they are often fearfully realized; and by preserving the disposition to fall off, we increase the liabilities of being brought by the lee.

When the masts are stayed in a *perpendicular* position with respect to the keel, the effort exerted by the wind on the sails, will be in a horizontal direction. Under these circumstances, her progressive movements will be uniform, and the resistance and velocity constant; while the objectionable features, visible in the face of the preceding system, are entirely obviated, and every favorable effort communicated, which can insure speed and safety.

Lastly; where the masts are made to rake *aft*, an increase of after-sail is thus given to the ship; as also a disposition to approach (rather than recede from) the wind; by which we obtain rapidity of movement, in the evolution of tacking. The effects produced being nearly conversely to those which are developed by raking the masts in an opposite direction, and more favorable to the sailing capacities of the ship, as we obviate to a great extent the tendency to pitch and the difficulties of bracing.

The most general custom has been to stay the fore-mast plumb, the main-mast with a slight rake aft, and the mizzen a little more raking than the main.

Staying Lower Masts. The bowsprit is now supposed to be well secured, the shrouds and bobstays set up, and the gammoning passed, or firmly set by the nut and screw or turn buckle. Proceed then to stay the foremast, to do which it must first be got into position by two pendant tackles hooked to the forward legs of the mast-head pendants and leading aft, and a runner and tackle (a pendant tackle for a small vessel) leading forward to the knight-heads or bowsprits; the after pendant tackles setting up to the eye bolts well aft. See Figure 316, Plate 45.

With these purchases, and the wedges, eased up, the mast can be stayed plumb, or with a slight rake, as may be required.

When in the right position, belay the falls and rack them well; put in the wedges for a full due, and put on the mast-coat.

It will be observed that the mast is not to be brought into position by the purchase *on* the stays, but by the Runner. After racking off the falls proceed to

Set up the Lower Stays, observing first, to let the collars down snugly over the eyes of the lower rigging, and to pass the remaining turns of the eye-lashing—*not*, however, so as to bring

the legs "eye and eye," as the stay can be set up afterwards *aloft* (if the amount required be but slight), without the trouble of casting off the seizings, and working on the reeving end, by getting the mast forward by the runner and tackle, and then setting up on the lashing with heavers.

At the distance of eight or ten feet up the stay, clap on the single-block of a luff tackle (having canvas underneath to protect it from chafe), and hook the lower one to a strap around the end of the stay, rove from *forward aft*, through the thimble. Then to a blackwall in the hauling part, which leads upward, hook the *single* block of another luff (the double one of which is tailed on to the stay higher up), and lead the fall of this last-mentioned luff, down through a single-block on the bowsprit, in a line with the stay, and hook on a deck-purchase, or pendant tackle, Fig. 316. Having got the stays taut (which will be the case when they form a *straight* line), pass the seizings (like those used in forming the eye of a shroud), and take off the luffs.

Reeving Full. Turn in the dead-eyes, for a full due,* by heaving the ends into their places (*inside* of the standing-part) with a strand of rope or rigger's screw, and pass the quarter and end seizings. Now reeve the dead-eyes full, by the following method, which is the most economical, and always insures a proper length: Place the coil, from which the laniards are to be cut, on deck amidships, on its edge, and take an end in each of the channels, beginning at the side-hole of the *lower* dead-eye, under the *standing*-part of the shroud, from *in out*, and reeve the holes full; turn a Mathew Walker's knot into the extremity of the laniard last rove (which will be under its proper part of the shroud, viz., the *end*), so that in setting up, the running part of the laniard brings the strain on the standing part of the shroud; clap on the bight, render all parts, haul taut, and cut off from the coil as desirable. By adopting this method, a little time is saved, as two laniards can be cut and rove at the same instant from the same coil.

Setting up Lower Rigging for a Full Due. Place canvas on the shroud about halfway up, to avoid chafe, and tail the single block of a luff over it. Turn a cat's paw into the bight of the laniard, and to a strap around a toggle thrust through, hook the lower-block (which is single also), and lead the fall up to the pendant tackle, as in Fig. 317, Plate 46. Set up all the shrouds in this manner, a pair on each side at a time for a full due (sending down the luffs), and secure the end of the laniard by thrusting it through the space between the dead-eye and throat-

* This supposes the old-fashioned dead-eye and that they had not been turned in, in the rigging loft.

PLATE 46

Fig 317.

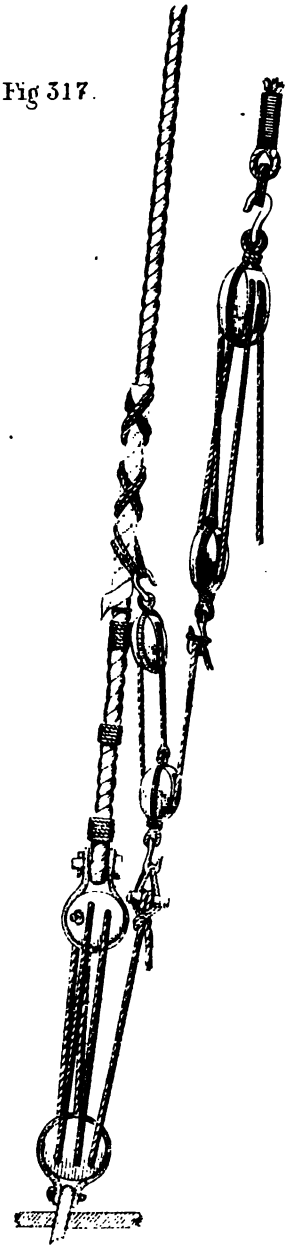
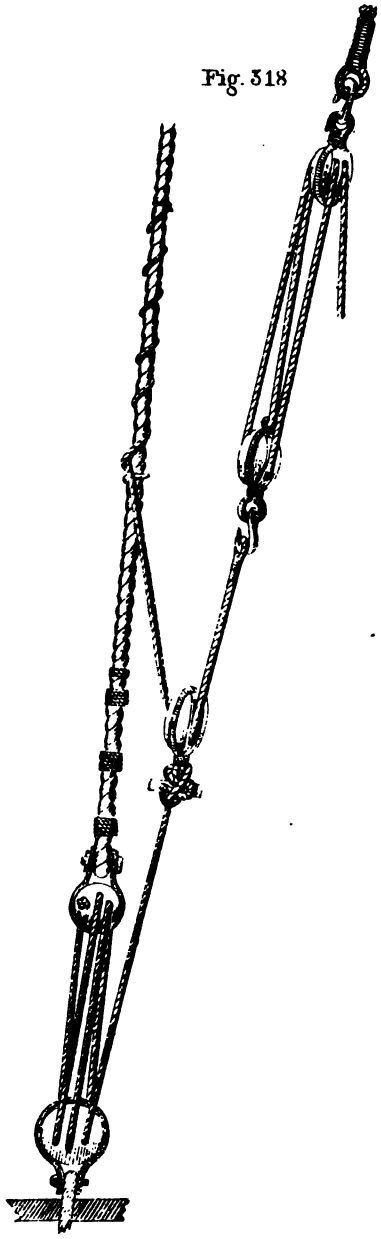


Fig. 318



seizing, around one part of the shroud, *inside* of both, and the other part like the first; thence back, as it came out, racking the end to the *inner* and *outer* parts. This is done to prevent the dead-eye (old-fashioned) from turning out, in case the throat-seizing should snap, and also as a support to it.*

When, after getting a pull of the pendant tackle, the shroud is sufficiently taut, rack the laniard with spun-yarn, until the end is secured as described, using a jigger to haul the turns taut.

After securing the end, take off the racking from the laniard, to bring an equal strain on all parts, and when everything has settled well into its place, two or three seizings of whipping twine are put on *every two parts*, that when the ship, working heavily, slackens the lee rigging and brings up again with a jerk, the strain may come at once on all parts of the laniard equally, and not on each part in succession.

Now seize on the sheer-poles with a cross-seizing, to keep the dead-eyes from slueing (on account of the tendency to unlay in the shrouds), having a strip of tarred canvas, or (which looks neater) leather underneath, to prevent chafe, and prepare to rattle down.

Having stayed the masts, wedge them, and put on the *mast-coats*, which are cut and made as follows, the material being either No. 1 or No. 2 canvas: Girth the mast round at eighteen inches above the deck. Girth also round the deck at three inches from the mast-hole. These girths give the circumference at top and bottom. The length is obtained by measuring straight the distance between the places girthed. Divide the lower girths into an equal number of parts, suitable to the width of the canvas, allowing for the *seams*, which are one inch wide. The cloths must be gored upward, to produce the circumference of the mast at the top girth; and, when sewed together, cut with a sweep to set neatly round the mast. The upper part is then sewed into a double collar six inches wide. To find the quantity of canvas in a mast-coat, multiply the number of cloths by the length, and add the quantity in the collar.

EXAMPLE.

Ft.	In.	
1	8	length.
	4	number of cloths.
6	8	
3	0	feet in the collar.
Total 9	8	

* Much that is said of the old-fashioned dead-eye is not applicable to the new.

RIGGING SHIP.

To Rattle Down. Hook the futtock-shrouds* to the plates in the top, observing to have the points of the hooks *in-board*, so that the bights of ropes from aloft, as studding-sail tacks, &c., are not in danger of being caught over them; and then proceed to rattle down, first girting the shrouds in and lashing oars or spars athwart the rigging, at the distance of four or five feet apart, for the men to stand on while at work.† The ratlines are usually of eighteen-thread stuff, fitted with a small, neat, spliced eye (thrust once and a half), which is seized on to the shroud with marline (or, which is nearer still, a ropeyarn, twisted up the opposite way and rubbed smooth), at the distance of fifteen or sixteen inches below the preceding one. A clove-hitch is then formed *outside*, around the next leg, with a marline-spike, and the ratline hove taut. In this manner it is made to reach the after-shroud, and then seized on as at the commencement; every fifth or "sheer" ratline being extended to the swifters, which, with these exceptions, are omitted.

The eye-seizing must be passed so that the eye will lie in a horizontal plane, showing but one part of the rope. Having spliced in the marline, pass it around the shroud, through the eye of the ratline, *back* around the shroud, and so on, as in Figs. 319 and 320, Plate 47.

A simple plan, where the ratline is too long to be seized on thus, and yet not sufficiently so to allow a new eye to be formed, is to heave turns in with the lay of the stuff, until shortened up as much as required. This is vulgarly defined an "Irish splice."

Now unreeve the girts employed in swiftering in, which tautens the ratlines and black the rigging.‡ After which, send down the spars, and square and cap the ends.

---

* At sea there is generally an ugly chafe between the lower and the futtock shrouds, to prevent which good iron scotchmen should be seized to the former.

† Prior to rattling down the rigging, a line parallel to that of the vessel's flotation should be drawn across the shroud-legs (on both sides), through the points where it is intended to seize on the lower ratlines, in order to have them correspond with her "sit" upon the water. And if these marks be continued up to the tressle-trees, at a distance apart varying from fourteen to sixteen inches, as the rigger may choose (that being the extreme separation), the work may be greatly facilitated by commencing with three or four ends of the ratline stuff at the same time, in as many different places on the rigging, and without the necessity of referring constantly to the "measuring stick."

Nothing is here said of *neatness* in this particular, as it is supposed to be a consideration sufficiently regarded by every rigger; since no neglect is so palpable, even to the eye of the most inexperienced, as that of rattling down the rigging in a careless and slovenly manner.

‡ Various compositions have been used for this purpose. *Glascock* recommends "Stockholm tar, with a certain portion of salt-water, boiled together—and put on hot." *Fordyce* says, "Stockholm tar, coal-tar, and salt water in equal proportions,

PLATE 47.

Fig. 319.

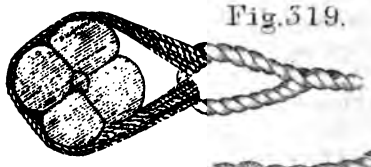


Fig. 320.

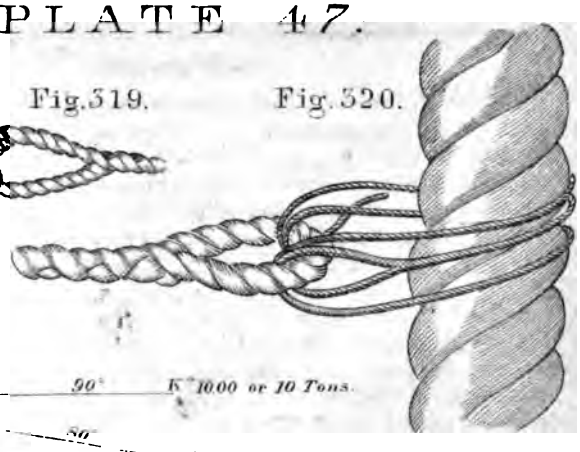
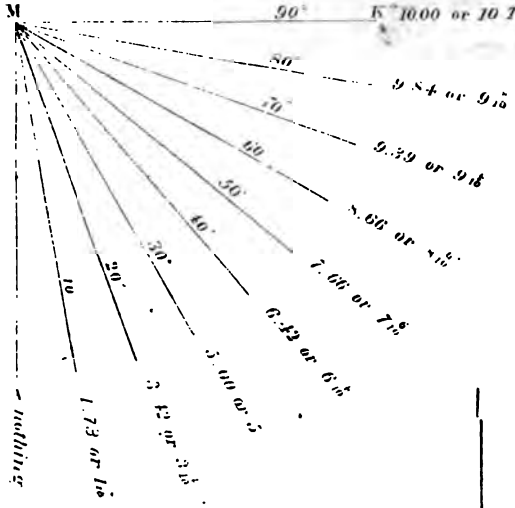


Fig. 321 a



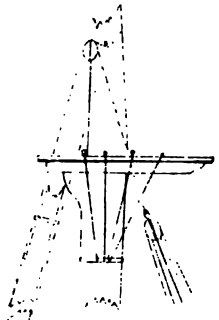
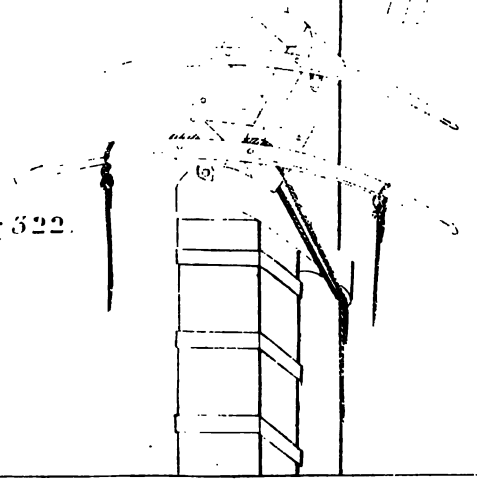


Fig. 321

Fig. 322.



RIGGING SHIP.

In sparring down rigging the forward ends should be square with each other, the spare ends aft. In rigging of nine shrouds one man should clap on four ratlines in an hour.

When *squaring* ratlines on going into port, a spar should be slung outside the rigging by a whip to enable the men to tend themselves.

The first two or three ratlines above the sheer pole, are now generally made of rod-iron to prevent getting out of shape when the rigging is manned previously to laying aloft.

NOTE. The "full due," referred to in the preceding paragraph is by no means intended as the only or final setting up the rigging is to receive in the vessel's outfit. The season of the year, the length of time in port, and the celerity or tardiness of equipment, are all circumstances which make it necessary either to give the rigging other *pulls*, or to afford opportunities for doing so. *Fordyce* thus states the criterion of the British service :—

"Forty-eight hours, or so, after placing, setting up, and swiftering in the rigging, if the weather be favorable, get another pull of it, and mark off for squaring.

"Five or six days after this, get a third pull, turning in the dead-eyes, with their proper seizings to the squaring marks, and bringing them down for good and all. Rattle down the rigging.

"Square off and point or cap (with canvas or leather), the ends of the shrouds, and point, or whip the ends of the laniards.

"Another, or fourth pull of the rigging (supposing it to be new), a fortnight or so after the third, will amply prepare it for sea, if the weather prove favorable."

REMARKS ON STAYING LOWER MASTS.

If, at any time, the rake of a lower mast requires altering, the same preparations, described for staying, must be made, and the wedges knocked out; otherwise the mast would be buckled, with one line from the step to the spar-deck partners, and another thence to the mast-head, the latter being curved.

Buckling a lower mast and getting it out of a vertical plane, are by no means uncommon. It would be well, therefore, particularly in the absence of a correct and practised eye, to observe the following directions for

heated up in a fish-kettle." *Brady* suggests the following: "To half a barrel of tar, add six gallons of whiskey, four pounds of litharge, four pounds of lamp-black, two buckets of boiling beef-pickle, or hot salt-water; mix well together and apply immediately."

RIGGING SHIP.

Staying a Mast by the use of Battens. Conjointly with marks on the deck and masts, battens are used in setting up rigging, to show whether the mast requires going to starboard or to port, forward or aft. To cut them, in the first instance, draw a line from the centre of the mast-hole across the deck, measure off two equal distances on each side of the mast, and mark the extremities. Take two long battens of equal length, place one end of each on the marks on each side of the deck, and rest the other ends against the mast. Pull the rigging up on either side, till the two ends come abreast of each other, and the mast must necessarily be upright. Drive a nail on each side of the mast and deck for permanent marks; but one batten only need now be retained.

The rake being determined, say half an inch to a foot, a plumb-line is dropped from the centre of the mast, from any distance up, and the mask raked till a corresponding distance is plumbed. If, for instance, the plumb-line is dropped from the tressle-trees at sixty feet, the line must plumb at thirty inches abaft the mast.

The rake of the masts has reference to the keel; but, as the deck and the keel are not parallel, the angle between their planes must be considered, when determining the angle the batten should have to the deck, in order that it may have the assigned angle to the keel.

Draw a fore-and-aft line from the centre of the mast, place the end of the batten on it, either before or abaft the mast as most convenient; mark where the ends take the mast and deck, with a couple of nails, which, with the side marks and this batten, are for future guidance, it being needed merely to place the batten afterwards against the mast, to show how the latter requires to be moved. In consequence of the injudicious manner in which masts have been stayed, and the lower rigging set up, they are frequently crippled; therefore, to regulate the setting up of rigging, and to determine if a lower mast is straight, a middle line should be cut on each of its sides and upon the after part. These lines should be painted a different color from the rest of the mast, and extend from the tressle-tree to the heel. At the upper part of each line, a small eye-bolt should be placed and on the line near the deck another such eye-bolt. A rope-line fastened to the upper one, and rove through the lower, and pulled tight, will, if the mast be straight, coincide with the middle line cut upon it; or, if not straight, the fact will be evident by the cut-line and the rope not being parallel. The amount by which parallelism is departed from, will represent any curve the mast has taken.*

* From English Navy Regulations.

OBSERVATIONS ON THE TENSION NECESSARY TO GIVE RIGGING.

As the setting up of rigging is a matter of considerable importance, in the economy of a ship, it is thought best to give the following judicious remarks on the subject by *Tinmouth* :—

The effect of a great strain has been stated, and the progressive effect will be detailed; but on the present subject it may be mentioned, that a permanent extension in the length of a rope, is the first indication of a permanent reduction of its strength, and as this change is produced of a strain less one half its full strength, it follows that, although trifling in extent, a constant application of the same strain must in a given time exhaust the whole strength and break the substance. The knowledge of this fact offers a valuable and useful lesson to all who have the care and management of standing rigging, particularly when it is new and liable to serious injury by injudicious haste in overstraining it.

The rope in its original state possesses the valuable properties of strength and elasticity, upon which depends the extent of durability. The perfection of these properties, so valuable in practice, may in a great degree be preserved by economy in management. It must, however, be admitted, that the usual manner of treating new rigging is the reverse of what it should be to attain this end. A system is pursued, with the apparent object of arriving, in the shortest possible time, at some imaginary point of stretching where it seems to be supposed the extension of the rope will in a great measure terminate; and for this purpose it is set up almost daily during the period of fitting the ship for sea, swiftering* it in on each occasion to hasten the operation; and it is of course during this time exposed to all the fluctuations of temperature in a variable climate, where cold rain will in a few hours so contract the material, as to produce a breaking strain. The whole intent and purpose of this proceeding is to stretch the rope well before the ship proceeds to sea, and when it is accomplished, no matter to what extent, it is still supposed that the full original strength of new rigging remains undiminished. No greater delusion can be entertained, neither can it be too extensively known, that the expenditure of strength in rope is progressive with the amount of strain applied and in strict proportion to it; so that even a moderate tension renders a permanent extension in length inevitable, and a consequent permanent reduction of circumference. Hence it follows that the sectional area of substance which is the measure of strength, diminishes

* Swiftering in lower rigging as here spoken of, is no longer practised. The method of doing it was similar to that prescribed for the Minnesota in the chapter on parcing rigging, which see. The custom went out with lower cat-harpins.

by every fresh application of strain, until, as has been already stated, the material is destroyed.

A calculation has been made showing that when sailing on a wind in a strong breeze (say 2lbs. per square foot), under top-gallant sails, the effort on the mast is to the support given by the shrouds as 1 to 6.48.

If 9lbs. be taken as the force of the wind, the strain on the mast will be 982 tons, and the support of the shrouds 5,069 tons, giving a ratio of 1 to 5.1.

The calculation is not to be regarded as minutely correct in all the details, but it is sufficiently so to prove that a tension of one quarter the full strength of the supporting ropes would be ample security to the mast, allowing at the same time for the effect of the momentum caused by the rolling of the ship; and this strain of one quarter, above proposed, might be continued for several years without any serious loss of strength to the rope, thereby insuring the valuable advantage of durability.*

Enough, perhaps, has been said to excite attention to the injurious effects of a great strain upon standing rigging; but one case may be mentioned to show the reality of much risk and danger to life and property by pursuing the practice.

An East-Indiaman, of 1,400 tons, sailed from the Downs in 1829, for Madras and China, laden with a general cargo. She had been fitted in the Thames with a new set of lower rigging, which was frequently set up; and during the early part of her outward voyage she sprung a leak, and put back to Portsmouth, where she was taken into one of the Government Docks. It was found that the downward pressure of the mainmast had started the garboard streak, which rendered the removal of the mast necessary to fit another step.

The contraction of the rope by the effect of cold rain has been mentioned, and it is extremely probable that the immense downward pressure in the present case may have originated in that way immediately after the rigging had been set up.

The effect of downward pressure by the masts has been noticed in many ships, and was conspicuously evident in all the ships captured at Antwerp in 1814. Within a certain radius of the wedges round the mainmast, a depression of the deck was in every ship visible, occasioned no doubt by the weight of the mast, and a great tension on the shrouds.

* Much of the trouble attending the use of hemp lower rigging, is obviated by *the use of wire-rope.*

TENSION OF RIGGING.

It appears to be of more value to have an equal strain upon each, rather than a great strain upon all the shrouds; because a ship sitting upright in the harbor or anywhere in a quiescent state, presents a favorable opportunity to economize the strength of rope by an easy tension upon the shrouds, such as they can well sustain without loss of original strength.

A short rule might be useful to calculate the comparative effect as a support with reference to the strength of a rope when applied at various angles.

In Fig. 321, Plate 47 (a), let a rope be applied from K to M for the purpose of resisting a force acting in that direction; the strength of the rope being 10 tons, what effect would it have if applied at any of the angles 10°, 20°, 30°, &c.

Rule. Sine of angle × tension = effective force.

It will be perceived, that if the rope be applied from M to A at a right angle with the force, it can have no effect as a support, and that at every 10° it will increase, as marked against each division up to K, the maximum strength of 10 tons.

The stretching of the rope is an evil which cannot well be altered, and will always require considerable attention; but there is another cause operating in the same direction, and nearly to the same extent, which, with common care, might be in part, if not altogether prevented. The cause here alluded to, is in the mode of placing the shrouds over the mast-head, the permanent position of the eye being entirely lost sight of in the endeavor to perform the whole operation in the shortest possible time. The consequence is, that the eyes of the rigging keep shifting their position down upon the mast-head for many months afterwards, producing as much slack rope, if it could be fairly measured, as the whole amount of stretching on each pair of shrouds.

It may be briefly stated, that what is here recommended, is merely to deal with each pair of shrouds separately at the time they are placed over the mast-head; and it may be observed that percussion, by far the most valuable means of accomplishing the object in view, cannot be made available after the eyes of the shrouds are all piled up one above the other upon the mast. It must be applied to each of the eyes successively in connection with downward pressure, in order to insure a permanent and solid bearing, and prevent the possibility of any alteration afterward.

There is another serious evil arising from setting up rigging too taut, which is particularly observable in small vessels and obtains more or less with large.

RIGGING SHIP.

Let the shrouds of a schooner be pulled up as taut as "harp-strings," as the expression is, then the liability is that when she goes to sea she will lose her masts; for when she rolls, the shrouds, which we will further suppose to be half worn, and with little *give*, keep the mast-head to windward, while the tendency of the rest of the spar is to buckle to leeward, and this is particularly the case when reefed down.

The routine of rigging embraced in the foregoing article refers exclusively to the foremast: yet the difference in the other masts is so immaterial that it is only necessary to allude to a few peculiarities. Over the mainmast-head, no clump-blocks and straps are placed, and the mizzen lower-pendant, which is single, is fitted with a cut-splice, while the odd shrouds (although disapproved of by seamen generally) are fitted with horseshoe eyes.

Topmasts. The operation of getting in topmasts, in lieu of being confined to one particular method, is performed differently by almost every rigger. The following method is selected, as the best and simplest. Acting upon the supposition, that the ship is moored in the stream, tow the mast alongside with the *head* forward,* having previously secured a large bull's eye, or single block, to the hounds on each side, in the same plane with the lower sheave-hole.

Hitch the end of a hawser at the lower mast-head, above the eyes of the rigging, leading through the hole in the tressle-trees, and reeve the other end through one of the bull's-eyes (or blocks), on the topmast and the sheave-hole; thence up through the opposite bull's-eye, and a block lashed at the mast-head, through the lubber's-hole, as in Fig. 321, Plate 47, leading it to the deck, and clapping on a pendant-tackle, or take the hawser to the capstan. With this purchase, and by means of easing-guys and jiggers, sway the mast inboard, and up and down the lower-mast.† Should the topmast prove too long, the head must be swayed up outside the top rim; then open the deck-scuttle, and lower the mast, until clear of the top rim; sway it up, and point it through the tressle-trees and round-hole of lower cap. The latter is sent up "before all," with the girtlines, immediately after rigging the lower-mast, by bending them on through the round-hole, and stopping them along to the after-part, observing

* It is recommended in all cases of getting spars on board while in the stream (where there is a *tide*-way), to tow them alongside in the reverse manner—a topmast, for example, with the *heel* forward, &c.; then by letting the foremost end be swept aft, by the current, during the operation of swaying it on board, there will be no necessity for a hauling-guy to rouse the heel foward *against* the tide.

† *Supposing* it to be the foremast.

PLATE 48

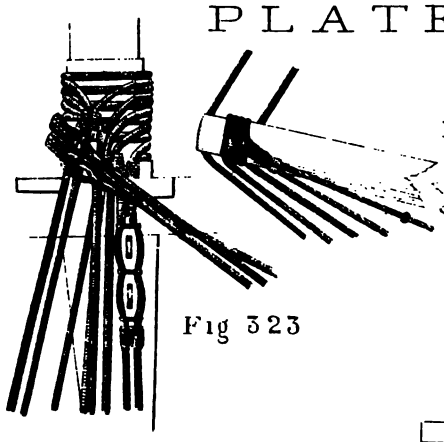
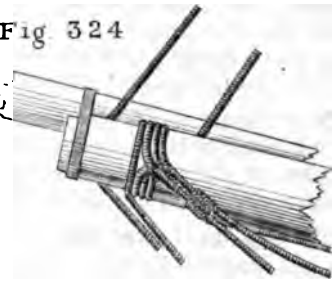


Fig 323

Fig 324



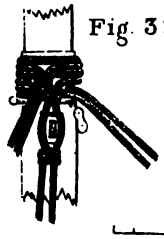


Fig. 326

Fig. 325

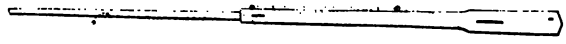


Fig. 327*a*

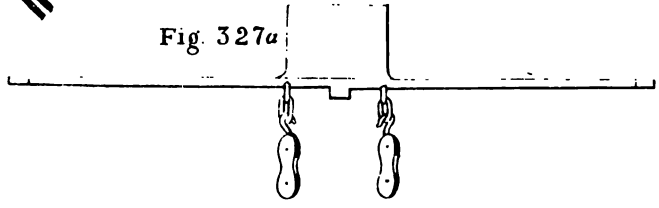
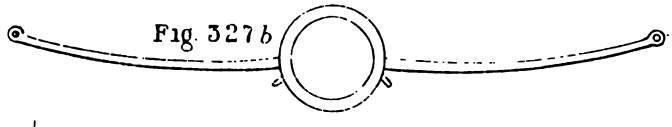


Fig. 327*b*



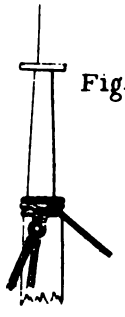
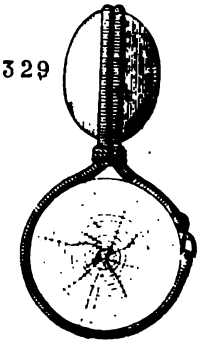


Fig. 328

Fig. 329



to keep the bolts *uppermost*, so that they do not come in contact with the top rim, &c., in the cap's passage aloft. When in the top, place it right side up over the square hole in the tressle-trees fair for pointing the topmast.

Now pass a stout strap through the fid-hole of the topmast, to which hook both the pendant-tackles; take off the bull's-eyes (or blocks) at the hounds and mast-head, unreeve the hawser, and prepare for shipping the CAP, which is done as follows:

To Ship the Lower Cap. Having sent the cap up into the top as just described, pass secure lashings through the eye-bolts, over the topmast-head (or *wedge* the cap), and sway up on the pendant-tackles, until clear of the tenon of the lower-mast; then slue the heel of the topmast, by means of guys bent to the extremities of a long heaver placed in the fid-hole, until the cap is fair for shipping. White-lead the tenon and mortise; send up the cap-shore (to which a laniard should be attached for the purpose of securing it aloft), and lower away, beating the cap down in its place, and tacking a piece of sheet-lead over as a protection from the weather.

To send up the Topmast Cross-trees. Fig. 322, Plate 47. Cast off the lashings (or remove the wedges), and sway the topmast-head a few feet above the cap. Lash a couple of stout burton-blocks to the tenon (having the falls rove), which should be sent down abaft for the cross-trees (placed on deck *well* abaft the mast). Secure the lower blocks to the after ends of the tressle-trees on the *upper* side, and stop the standing parts along the forward ends, in the same manner as that resorted to in sending up the lower tressle-trees; having a guy from the mainmast-head (if the fore-topmast cross-trees), to keep them clear of the top in going aloft. Sway up on the burtons, bear off, cut the stops as necessary, and land them on the lower cap, where they should be securely lashed, having the forward part inclined upward, with the chock resting against the topmast. Cast off the burtons, remove the blocks from the tenon or—if girtlines are used to get the cross-trees aloft (as is sometimes done)—shift them at once to the after-horns, ready for the rigging; white-lead all parts in the wake of each other, and lower away on the pendant-tackles, until the cross-trees come fair over the mast-head, cutting them forward, or aft, as may be necessary.

To Rig Topmast. Fig. 323, Plate 48. Now sway up on the pendant-tackles, and lodge the cross-trees on the hounds of the topmast, prying up the after-end, and beating them down in their places. Hook the top-blocks in the lower cap and reeve the top-pendants, by passing each pointed end through its respective block, and sheave in the heel of the topmast, and clinching it

over the cap on the opposite side, and *not* "to the eye-bolts;" after which hook the *top-tackles* to the other ends (fitted with thimbles), and remove the fid-strap and pendant-tackles used in pointing the topmast. Attach a girtline-block to each after-horn of the cross-trees, and prepare for rigging. Send up and lash the bolsters, well protected with tarred parcelling, and bolt the *gin-bar* down securely in its place. This consists of a short, stout bar of iron, placed across the topmast tressle-trees between the "doublings" of the masts with links for the gin-blocks.

Burton-pendants are sometimes fitted of chain of proper length, which hook to eye-bolts in the under side of topmast tressle-trees, having a large link in the lower end for the burton to hook to. When fitted of rope, these pendants go over the mast-head with a cut-splice.

Objections are frequently made by seamen to rigging the topmast before fidding, on account of the increased weight thereby brought upon the top-pendants, which (considering the advantages of safety, and a top unencumbered with rope) are not without some shadow of reason; and since it is usual to fid the mast first, in order to ascertain its fit, etc., before rigging, the method should be adopted. Having then fidded the topmast and steadied it by burtons or guys, proceed to get the shrouds and backstays up and over in the following order, after the manner employed in LOWER-RIGGING, observing to have an eye-girtline at the tenon:

First. Starboard and port shrouds alternately—the odd ones being fitted with horse-shoe eyes.

Second. Back-stays.

Third. Fore-and-aft stays.

Finally. Send up the jib-stay (if the boom be rigged out at the same time), and reeve the topmast-stays through the bees on the bowsprit, clapping luffs on them, to give the masts the proper stay. Then proceed to set up the rigging by means of a runner and burton as follows:

To set up Topmast Rigging, Fig. 318, Plate 46. The runner, (which has a thimble in one end) being rove through a single block, hooked to a cat's paw in the laniard, is tailed on to the shroud-leg about six or eight feet above, and the lower block of the top-burton then hooked to the thimble, as in Fig. 318. Having set up the shrouds by means of this purchase in a manner precisely similar to that adopted in the case of the lower-rigging, turn the dead-eyes in to the standing back-stays and set them up

also. Lash on the sheer poles and futtock-staffs*—the latter *inside* of the topmast shrouds, and swifter in. Seize the forward cat-harpen legs† (on each side) to the forward shrouds, and the after ones (around the mast) to the after shrouds—then spar, and rattle down, cap, and square the rigging. Reeve and fit the netting on the top-railing, and sway aloft the topmast cap, which should be placed on the fore part of topmast cross-trees ready for shipping. Lastly, send down the girtlines from the tenon and horn, used in getting the rigging over.

When the jib-stay is fitted with a collar, like the topmast-stays, it is dipped through the two latter so as to avoid chafing the foot of the fore-top-gallant-sail, as much as possible, Fig. 323, Plate 48.

In most of our ships and particularly those of a later date the topmast rigging is simply rove through large bull's-eyes, and sets up on its own part instead of with dead-eyes and laniards. Sometimes, after the lower and top masts are rigged, a tarpaulin coat fitting snugly, is placed over the eyes of the rigging, as a protection from weather. This answers very well, and if painted white, does not detract from the neat appearance of the mast-head.

Jib-Boom, Fig. 324, Plate 48. Bring the boom alongside with the head forward, and reeve a spare piece of rope (studding-sail halliards if at hand), through the sheave-holes in each end, a sufficient number of times, and make it fast. Overhaul down the main pendant-tackles, and hook it into a cuckold's-neck formed in the bight of the span, having the boom to hang slightly *heel* heavy. Sway it up, bearing it clear of the ship's side—ease it inboard, and land it in the gangway; unreeve the span, and carry the boom forward, pointing it through the bowsprit-cap, and reeve the heel-rope, which is done as follows: Pass one end through a single-block, hooked to an eye-bolt on one side of the bowsprit-cap; thence through the sheave in the heel, and clinch it to the other bolt, on the opposite side of the cap. Man the heel-rope, and rig the boom out, until the shoulders are just forward of the bowsprit end; then tar them in wake of the rigging, and get over the *foot ropes first*, which are fitted with neat spliced eyes, in the outer ends (thrust once

* Which should be made of iron rod and well parcelled and served, in order not to chafe the top-gallant rigging, as they are only used for it to lead over, in its course to the top.

† They should be fitted short enough to admit of being frequently set up, before they become so much stretched as to make it necessary to send them down to alter. This and the futtock-staff are dispensed with by the arrangement shown in Plate 32.

and a half), and wormed and served. The strands are then unlayed up to the service, and Mathew Walker knots worked in at equal distances (to keep the men from slipping, on account of the steeve of the boom); after which, the rope is again laid up, and the inner ends formed into artificial eyes, which are seized to bolts in the bowsprit-cap. Thus fitted, they should be long enough to allow the men, who go on the boom, to stand with the lower part of their breasts against it. Next, put over the *jib-guys*, and the eye of the *martingale-stay*, made in the same manner as those for the foot ropes. Reeve the jib-stay through the inner sheave-hole of the boom-end; sway the dolphin-striker up by means of a tackle from the bowsprit-cap, hooking it to its eye-bolt, and put over the lower eye of martingale-stay, and the gob-lines or back-ropes fitted with a round-eye in one end, and a thimble and laniard in the other, which latter connects with a bolt on either bow. Finally, ship the wythe for the flying-jib-boom; man the heel-rope, and rig out, placing the heel in the saddle, and clamping it. Pass the belly-lashing, set up the guys, jib, and martingale-stays, seize the top-gallant bowline-blocks to the jib-guys (far enough out from the shoulders to allow the flying-jib-boom to pass clear), and unreeve the heel-rope. The martingale-stay sets up by pulling up on the back-ropes.

The jib-netting is made of ratline stuff and laces to the guys and whiskers.

NOTE. The plan now most generally adopted for fitting foot ropes is as follows: to go over the boom-end a cut splice, or what is the same thing, a short piece of rope with both ends spliced in on each side of the centre, forming an eye to fit snugly over the boom-end. And to prevent it from sagging from side to side, by the weight of the men, it is seized to the jib-guys.

Turk's heads are worked on them in lieu of the Mathew Walker knots.

Fig. 324, represents the head-booms having the fore-royal-stay passing through a score at the extremity of the boom. This is to facilitate the shifting of the spar, but the plan has never found much favor in our service.

Top-gallant-mast. Lash the top-gallant-top-block aloft above the eyes of the topmast rigging, and reeve the top-gallant-mast rope, first, through the block, then the square hole in the cross-trees, and lastly the lizard, Fig. 325, Plate 48, at the royal-mast-head, and the sheave in the heel, seizing it to the hounds of the top-gallant-mast, and leaving end enough over to clinch to the eye-bolt in the upper cap (when shipped), before fidding. Rack both parts of the mast-rope securely together just above the *lower* sheave-hole. Send the hauling-part down through the

cross-trees and lubber's-hole to the deck, and sway aloft, bending a tripping-line on through the fid-hole to guy the mast clear in its passage up. Point the head of the royal-mast through the cross-trees, take off the lizard (which is now of no further use), and prepare for shipping the upper cap. Sway the mast up through the latter—placed *above* the collars of the stays, and secure it to the hounds of the royal-mast by means of wedges and lashings. Sway higher, and proceed after the manner directed in shipping the lower cap.

The topmast-cap may be shipped and unshipped by means of a derrick formed of a capstan-bar or other suitable spar, lashed up and down the mast-head and wedged out so as to admit the cap coming down between it and the tenon.

Top-gallant Rigging, Fig. 326, Plate 48. Remove the lashings and wedges, and clinch the end of the mast-rope to the eye-bolt in the cap, slacking down the former (kept from rendering by the rackings), in order to take the strain from the top-block, which must now be unlashed and hooked to its proper eye-bolt also : after which, cut the racking and seizing at the hounds, letting the mast hang by the mast-rope, the hauling end of which is belayed on deck. Lash a stout girtline-block to the cap, and overhaul the line down abaft all for the jack and funnel,* Fig. 327, which should be placed on deck, with the rigging over in the following order, the eyes being covered with canvas and made to fit the cylinder exactly :

First. Fore-top-gallant-stay.

Second. Flying-jib-stay.

Third. Shrouds.

Fourth. Back-stays.

If the main-royal-stay is to lead to the fore-top-gallant mast-head, then put over first the strap and thimble for it, but this lead for the stay is not recommended.

Bend the girtline to the rigging around all parts, the length of the *topmast*-head below the jack, and put a good stop through the cylinder, sending it aloft, with a guy attached, to keep it clear. Cut the stop when high enough, and place the jack over the cap, assisting to do so, if necessary, with a rope's end through the royal sheave-hole. Now lower the top-gallant-mast, cutting the cylinder forward, until it is fair over the hole, and lash it, for fear of accident. Reeve the top-gallant shrouds

* The rim of which should be rounded off, or filled with lead, and a circular piece of canvas placed over to prevent chafe.

through the horns of the cross-trees, or *snatch* them, if the horns are scored out and fitted with clamps, then between the topmast shrouds, *over* the futtock-staves, and thence into the top, where they set up to their own part through bull's-eyes. This rigging can be set up by jiggers. Place the royal-rigging (sent up by the girtline also), above the funnel.

Royal Rigging, Fig. 328, Plate 48. Sway up on the mast-rope, point the royal-mast head through, ship the truck (with signal halliards rove, spindle and conductor,* attached), and fit the *royal-stay* down on the hounds (above which a grommet† is sometimes worked); then the *shrouds*, and lastly the *back-stays*. Reeve the shrouds through the jacks, to the top, the back-stays to the channels, and the fore-and-aft stay forward, through the outer hole in the flying-jib-boom. Cast off the funnel-lashing from the cap, man the mast-rope, unbend the tripping-line, sway up and fid, setting up the rigging *temporarily*, to steady and secure the mast.

The thimble for the royal lift is seized in between the shroud and back-stay.

The royal rigging is now generally fitted over an iron cylinder.

Before swaying aloft, get jiggers on the back-stays and fore-and-aft stays to steady the mast as it goes up.

The Fore-top-gallant Stay reeves through the outer sheave or score in the jib-boom, the fore-royal through the outer hole in the flying-jib-boom.

The Jib, and Flying-jib-stay, reeve through the inner sheaves or holes in their respective booms.

The Main-top-gallant-stay, reeves through a sheave in the after chock of the fore-topmast cross-trees, and sets up in the fore-top.

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* Some years since, a lightning conductor was invented by Capt. Harris, of the British Navy, and subsequently adopted throughout that service. This consists of a continuous line of double plates of *copper* (38 oz. per square foot) let into a groove on the after part of the masts, and extending from the truck spindle to the lower cap, gradually increasing in width from two and a half to four inches. At the cap, the conductor meets a similar line of metal running entirely through the centre of the lower mast, which is stepped upon a broad plate of copper on the kelson—whence the fluid is discharged by means of bolts of copper running through and through at each extremity of the plate. The advantage of this method consists in the fact of its being a better conductor of lightning than iron, in the ratio of six to one; and by being made of *plates*, in lieu of rods or links, it exposes *four* surfaces to the action of the fluid, besides imparting to the lighter and loftier masts a very considerable degree of support.

† In the merchant service, this grommet is fitted with becket, or thimbles, for the royal lifts.

RIGGING SHIP.

The Main-royal-stay reeves through a thimble strapped around the fore-top-gallant mast-head. It is sometimes brought down to the fore-topmast cap, so that if the fore-top-gallant mast goes, the main-royal-mast is not endangered, or in sending up masts, the main can be stayed without waiting for the fore. This method is now preferred.

The Mizzen-top-gallant-stay reeves through a small roller in the after part of the main cap, and sets up in the top.

The Mizzen-royal-stay leads through a sheave in the after chock of the main-topmast tressle-trees, and down to the lower cap or top.

Flying-jib-boom, Fig. 324, Plate 48. Sway it on board, either by means of a bill tackle on the topmast back-stay, or use the span, as directed under the head of JIB-BOOM, and get it ready for going out. Lash a single block to the jib-stay, through which reeve the heel rope, taking a hitch with the end over the heel of the boom, and clap stops around both to the shoulders. Pass *slip* ropes also over the jib, and flying-jib-boom (to hold the latter up in its passage out), and rouse on the heel-rope, pointing the end of the boom through the wythe, until the shoulders are clear of the jib-boom end. Tar them in wake of the rigging, and put over a *grommet.* Next the *foot-ropes* (fitted like those for the jib-boom), and seize the inner eyes to the jib-guys: then the *flying-jib-guys,* and lastly, the *martingale-stay,* which reeves *through* the dolphin-striker, and leads to the head. Reeve the flying-jib, and fore-royal-stays, cut the stops; rig out, and pass the heel and belly lashings. Set up the guys, martingale, and flying-jib-stays, and take off the heel-rope, set up the royal shrouds and back-stays, and finally, the fore-and-aft-stays, for a full due.

Small jiggers are clapped on these stays, and the mast stayed (*i. e.* lined), by the eye.

Topsail-Yards. Having towed the yard off to the ship, say on the port side with the starboard yard-arm forward, lash a large single-block at the topmast-head, having a strap sufficiently long to permit it to hang clear of the tressle-trees. Through this reeve a hawser down (outside of all), and bend it on to the slings of the yard, either stopping it to the forward (in this case starboard) quarter, with stout seizings, or use a lizard, and secure the ship's side from chafe by fenders and skids. Hook the port pendant-tackle, also, to a strap on the after-quarter, and man it, and the hawser (taken to the capstan), swaying the yard on board, which must be kept from canting aft against the mast, by means of a purchase or guy, leading from forward. Ease the lizard (or stops) as necessary, sway on the pendant-tackle, until clear of

the ship's side, and lower away, landing the yard as you had it alongside (viz., with the starboard yard-arm forward), in the port gangway, on chocks, which should also be placed underneath the *inner* quarters, to keep the yard from becoming bowed in the slings through its own weight. Now cast off the hawser and tackle; tar the yard-arms and prepare for rigging.

It is customary to place the fore-topsail-yard in the port gangway for rigging, and the main-topsail-yard in the starboard.

Tye-blocks. Although invariably iron-strapped, and connected by means of a bolt to a band going around the slings (after the yard is crossed), it is thought proper to describe the manner of securing the block when fitted in the old-fashioned way; as the present method, though by far the best and neatest, is nevertheless not entirely free from accident. Having leathered the slings, find the exact centre of the yard,* and heave the block into the strap (formed of a long and short grommet, wormed, parcelled and served), with a strand and Spanish windiass, and seize it *loosely;* after which, lash it on the yard with the breech fitting down snugly, and the sheave standing fore and aft, passing the rose-seizing, connecting the eye of the long grommet (going around the yard) to that of the short one, on the forward side underneath, Fig. 329, Plate 48.

Parrel. If the new parrel (Plate 32), should not be adopted, prepare to lash the rope one to the yard. This consists of a long and short leg, marled together and leathered, of sufficient length to go around the mast and yard on each side. An eye, which is wormed, parcelled and served, is spliced in the ends of the two legs, and stout quarter-seizings put on both, close to the eyes of the short leg. The long one is then passed around the quarter of the yard, just half the diameter of the topmast from the centre, and secured to the short one by a rose-seizing on the *upper* after side. When the yard is crossed, the remaining leg is passed on the opposite side, and secured in the same manner, Fig. 330, Plate 49.

In many instances in the service, *jaws* with a lashing (or a broad iron clamp) abaft the mast, have been substituted for the parrel here alluded to, and are preferred by many seamen on account of their durability, and dispensing with rolling tackles.

Quarter-blocks† should always be iron-strapped, on account of the facility with which the yards can be shifted, without the

* Where two tyes are used, as on board of heavy ships, the blocks are separated from each other by a space equal to the diameter of the topmast.

† It is quite common in the merchant service, to hook the clew-line block to the *lower cap instead* of to the quarter of the topsail yard.

PLATE 49

Fig 331

Fig 330

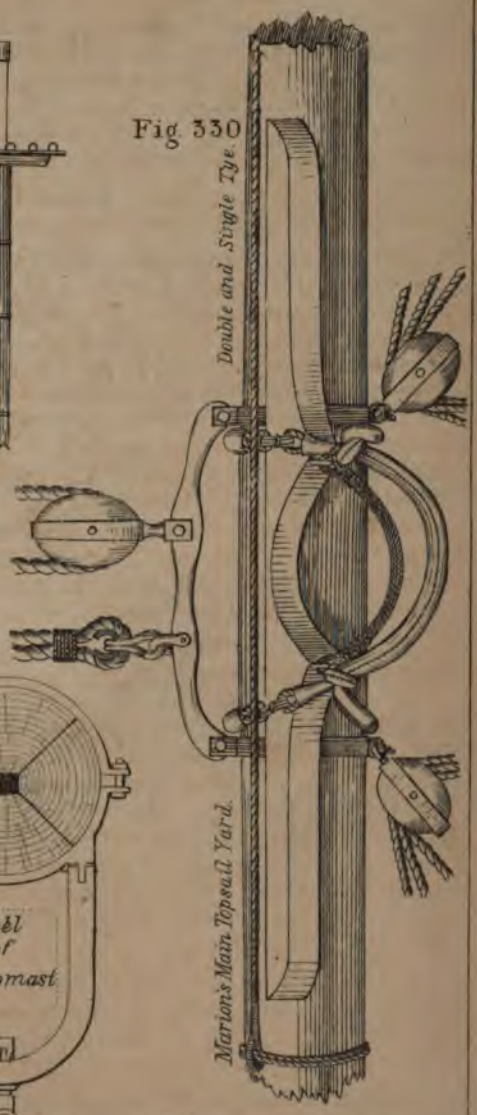
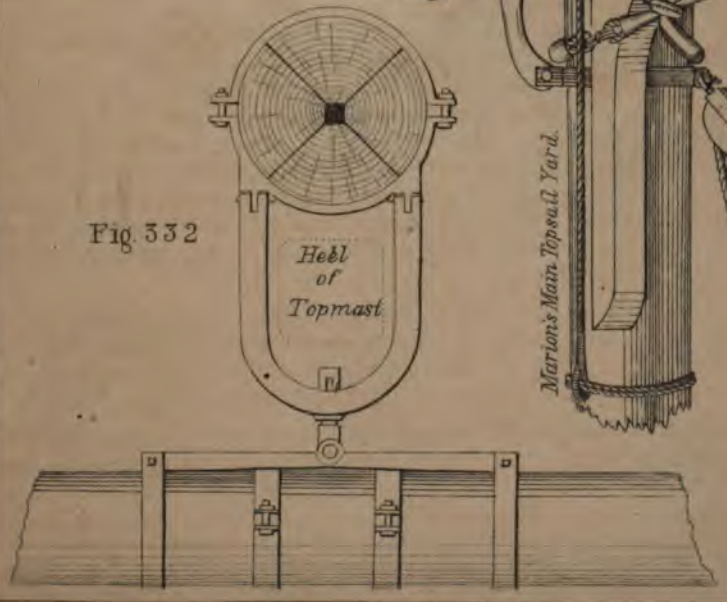


Fig 332



necessity of unreeving sheets and clew-lines.* When of rope, they are fitted with single straps and lashing eyes, which are served—the *after*-part only being leathered, to prevent chafe, and secured to the yard by a rose-seizing on top, having a span-lashing underneath, to keep them from spreading.

Straps and Thimbles (fitted with small eyes), for standing parts of topsail clew-lines. These are simply served and secured to the yard on top (close to the quarter-blocks), with rose-seizings.

These are almost entirely dispensed with now, and instead, either the standing part of the clew-line is taken around the quarter of the yard and secured to its own part, or the clew-line is fitted with a whip and pendant.

Rolling-tackle and Burton-straps. These are formed of grommets, doubled (*not double grommets*), and thimbles,† served and secured with rose-seizings on the forward side—the former, about one third the length of the yard-arm out from the slings, and the latter just inside of the sheave-holes. The jaws now put on yards render the former of these unnecessary, while the iron band and eye take the place of the latter.

Head-earing Straps and Thimbles. These are fitted in a variety of ways—sometimes of *sennit*, and nailed around the yard, or *in one* with the eyes of the jack-stays and foot-ropes. And, again, in the merchant service, an eye-bolt in the shoulder-band of the yard is made to answer the purpose. The first method is preferable. The second for neatness, although there is a sacrifice of security, which is hardly commendable; while the third has advantages over both in point of strength.

The usual method now in the service is, to have a head-earing strap and thimble on the yard-arm, to haul out the head of the sail, and then instead of expending the end of the earing around the yard to keep the head-cringle up, it is taken through the eye of a *backer*, which is a broad piece of sennit made for the purpose, and nailed around the yard, just inside the sheave, where the head-earing comes. For backer, see Fig. 349 Plate 55.

Jack-stays. Iron is used throughout the service; but where rope is preferred, they are served the whole length, and fitted to go over the yard-arm with eyes; after which, they are rove

* The quarter-blocks on board of some ships are *threefold*, in order to rece the reef-tackle, which comes in along the yard underneath, in lieu of reeving through the outer sheave of the yard to the burton. This is a good plan, as it serves the purpose of a downhaul-tackle in clewing down.

† The reason is obvious—for, in the event of parting the strap, it could be replaced without disturbing any of the other rigging, which would be impossible with a single grommet going *over* the yard.

through staples on the upper forward side (being protected from chafe by strips of leather),* and set up to each other in the slings, by means of small eye-lashings.

Foot-ropes. These are fitted with an eye, going over the yard-arm abaft, which is merely wormed, and the splice served. The eye is put on so that the neck of the splice lies *on top* of the yard. They are then rove through the stirrups and the ends (which are served as far out as they are liable to chafe from the topmast rigging), taken abaft the mast (*when the yard is crossed*), and secured to the opposite quarters on *top*, by means of an eye-lashing, passed over the yard, round on the forward side, underneath, up, and back through the eye again, a sufficient number of times; after which, two half-hitches are taken around all parts to secure the end. This plan of leading them is recommended, on account of the facility with which the men can get on and off the yard. In merchant vessels, and on board of the store-ships, the foot-ropes are fitted with a hook, which connects to an eye-bolt on the after-side of the shoulder-band.

Stirrups. According to the Book of Allowances, these are to be fitted without thimbles, but are to have an eye in the lower end through which the foot-rope is to reeve, and to which it is to be seized. The upper ends fitted with small artificial eyes, are seized to the jack-stay staples.

Brace-blocks. These are fitted variously. In the merchant service they hook to the shoulder-band on the yard. But in the navy, two straps are used, connected with lock-thimbles, and fitted as follows:—The *yard-strap*, into which one thimble is seized, consists of a grommet, wormed and covered with canvas, and fitting so snugly as to require to be driven on. The *block-strap* (a double one) is cut the necessary length, the ends spliced together, and then wormed and covered with canvas. After which, the bight is thrust through the other thimble, and both parts passed around the block, which is secured into the strap by a round seizing, between the breech and thimble, Fig. 240.

Lifts. They are formed with an eye, which, with the splice, is wormed and covered with canvas, and made to fit so snugly over the yard-arm as to require driving on.

Flemish-horses. These are spliced around a thimble on the pacific-iron for that purpose, and the eye in the other end secured on top of the yard to the jack-stay, the length of the shoulder inside of the sheave-hole, with a rose-seizing.

* The use of leather on rope is prohibited by the Book of Allowances.

Jewel-blocks, which are single and rope-strapped, are sometimes secured to a thimble around the pacific-iron, outside of that for the Flemish horse, and frequently fitted to go *over* the yard-arm; but the best plan (as it admits of their being taken off at all times without difficulty), is to connect them to the pacific-iron with sister-hooks.

Tyes. Generally of four-stranded hide-rope, though they might be of wire-rope. The lower end has a thimble spliced in to which hooks the fly-block. Passing through the gin-blocks at the mast-head, the reeve through the tye-block, on the yard, thence up through the topmast tressle-trees, and clinch around the mast-head. The heel of the top-gallant-mast, is scored out on purpose to admit the tye.

Small ships have a single tye only, while others have a double and a single tye. See Marion's top-sail yard, Fig. 330, Plate 45.

Fly-blocks, when the yards are down (four inches from the cap), should be square with the lower-cap. If not so, they may be regulated by taking up on the standing part as they stretch. Single tyes may well be made of wire.

See that the armorers and carpenters have prepared the yard, by attaching the boom-irons, reefing-cleats, bolsters (inside of sheave-hole), for top-gallant-sheets, etc., and prepare for crossing.

Reeve the hawser, used in getting the yard on board, through the thimble of a stout lizard (secured in the starboard rolling-tackle strap), and a large single block lashed on top of the yard, the diameter of the topmast outside of the tye-block (the starboard one, if two are used), clinching the end aloft, above the eyes of the rigging, and sending the other through the lubber's-hole to the deck. Coil the lifts on the quarters of the yard (stopping them to the jack-stays), and reeve the braces with marrying-lines, observing to dip the starboard (or *upper*) one *over* the lower stay. Overhaul the top-burtons from aloft, and hook them to the yard-arms; as also a fore-and-aft tackle to the slings to keep the yard from chafing against the mast, as it goes up.

Man the hawser and starboard burton, and sway away, carrying the *port* (or lower) yard-arm aft, and placing a mat under, to prevent injury to the deck. As soon as the yard is clear of the lower stay, ease the lizard and commence crossing, keeping to the slack of the fore-and-aft tackle, and hauling on the lower burton and starboard brace. Reeve the lifts through the sister-blocks, and as the yard rises above the lower cap, square it; bring to, and pass the parrel, or *truss* the yard, as the case may be, sending down the fore-and-aft tackle.

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Now reeve the tyes through the gins, and tye-blocks, and clinch the ends aloft. Hook the fly-block with the halliards rove, taking the strain from the burtons and hawser, which may be sent down, together with the yard-block and lizard, observing, lastly, to place a small square piece of wood between the slings and lower cap, to keep the yard from bowing, in case the halliards should be slacked, or let go; or, as sometimes practised in large ships, have a midship-lift fitted, of such a length as not to permit the yard to touch the cap.

N. B. This routine supposes the yard to be lying in the *port* gangway, with the *starboard* yard-arm *forward*.

Lower Yards.—*First Method.* Suppose the ship at anchor in a *tideway*. Having lashed a stout block, with a hawser rove, to the crotch of the lower-stay collar (supported by a burton from the topmast-head), tow the yard off to the ship, say on the starboard side, with the *port* yard-arm *aft*,* and secure a large single block to the slings, as also a bulls-eye on each side of the *port* quarter, well out on the yard. Through these reeve one end of the hawser, and clinch it over the lower cap, sending the other part through a leader on deck to the capstan, Fig. 331, Plate 49.

Secure the bends and channels of the ship from chafe by proper means, and heave away, having the *starboard* pendant-tackle in readiness to hook to a strap on the starboard (or *forward*) yard-arm; as also two stout fore-and-aft jiggers to the quarters. When the *after* or port arm rises above the gunwale, and clear of the lower rigging, cast the yard off from the ship forward, and as it is swept aft by the current, hook on the pendant-tackle and jiggers. With these sway it on board, and land it athwartships, on chocks, for that purpose, where it should be lashed to keep it steady, observing the precaution to place a shore under the slings, to prevent it from springing. After which, take off the blocks, bull's-eyes, burton and tackles, and send the hawser down from aloft.

Second Method. Lash the top-block to the mast-head, or hook it to a lashing passing through the pigeon-hole of the top and over the lower cap. Reeve and overhaul down the hawser, bend the forward end to the slings of the yard, and stop it out to the port yard-arm (supposing the yard on the starboard side). Take the after end of hawser to the capstan. Bend a guy to the slings of the yard and heave around on the capstan, till the upper yard-arm (the port) is above the bulwarks, then hook the pendant-tackles well out on either quarter, and sway away, casting off the stops on the hawser as the yard ascends; keep the

* When there is no tide, the reverse of this should be observed.

yard up and down with the port pendant-tackle. When the slings are above the rail, top up on the lower (starboard) pendant-tackle and ease away on the upper (port) one, crossing the yard and keeping it clear of the mast by the fore-and-aft guy. Place it as before.

A third method is to rig a fish-davit or derrick just forward of the lower rigging, overhaul down the purchase and hook it to the sling-band, having guys, skids, &c., as before. Sway away and when above the rail guy the forward yard-arm (the port) over to the opposite side, hook the pendant-tackles and land it as before, easing the yard inboard by means of a guy.

Now tar the yard-arms, and proceed to place the rigging.

Sling-bands. This is a modern substitute for the old D thimble, consisting of two stout iron bands going around the yard each side of and near the centre, and connected by an iron span, to which the slings are attached by means of the slip-hook. This falls within the province of the spar-maker, rather than the rigger.*

Quarter-blocks† are neatest if made of iron, with a stout broad sheave (of the same metal, when chain-sheets are used, or of *lignumvitæ*, with rope or hide), secured to the yard by a band, which is put on by the blacksmith. When fitted with rope, the blocks (which are large single ones)‡ are seized into *doubled* grommet-straps (that are simply served, and a strip of leather put on the *after* part, as a preventive from chafe), with a round seizing; after which, the straps are secured to the yard *on top* by a rose-seizing—the bights, or eyes, being hove close together with a heaver and Spanish windlass. The straps are then spanned towards each other, with a lashing underneath, to keep the blocks from spreading.

Truss-straps and Pendants. The adoption of the *patent iron truss*, Fig. 332, Plates 32 and 49, on board of nearly all of our vessels, has done away with the necessity of the strap and pendant of "earlier times." But in some ships-of-war, the "old fashion" (fitted as follows), still prevails. The *straps* (into which the truss-thimbles are seized), are formed of long and short grommets, made like those for the *tye-blocks*, and lash on each

* On board of vessels-of-war there are usually two additional bands, one on each side, for the *preventer* slings, or jeer-blocks.

† In many ships, a small single or double block is secured to the centre of the yard (*prior* to putting on the quarter-blocks), by a rope-strap fitted with lashing-eyes, for the *slab-lines*.

‡ In the merchant service they are more frequently *double* than single, in order to receive the reef-tackle, which is rove like that of the topsail-yard.

side of the slings with a rose-seizing *on top*, having the thimbles a little above the after centre of the yard. The *pendants* are best when made of four-stranded hide-rope, and leathered on the standing part, which is made with an eye, and rove around the yard.* The other end (when rove), is fitted with a single block, the strap of which is formed by the bights of the strands.

Clew-garnet Blocks. Although iron-bound, generally, they are sometimes fitted with rope-straps, which are single, with lashing eyes, going around the yard, and secured on top by rose-seizings. They should, also, be wormed and served, and protected from chafe on the after-part. Fig. 333, Plate 50.

Straps and Thimbles, for standing part of clew-garnet. These are single, and simply served, with lashing-eyes, which secure on top of the yard by a rose-seizing, *outside* of the clew-garnet-blocks.†

These straps have been given up and the standing part of the clew-garnet taken around the yard instead or seized to the jack-stay.

Rolling-tackle Straps. *Vide* TOPSAIL-YARDS. Not used with the patent truss.

Straps and Thimbles, for studding-sail-boom (somewhat more than halfway out), fitted like that for the standing part of clew-garnet. They are only used on the *fore* yard, except in a few ships, which carry a main-topmast studding-sail. These are now seldom if ever used.

Burton-straps. *Vide* TOPSAIL-YARDS.

Head-earing Straps, Fig. 335, Plate 50. *Vide* TOPSAIL-YARDS.

Jack-stays. Iron ones are universal now throughout the merchant service; and by a regulation of the Navy Department, the *bending* jack-stays of all government vessels are of iron also. But the method of fitting the courses without after-points, renders *reefing* jack-stays necessary. These are invariably of rope, and fitted in the same manner as those described under the head of TOPSAIL-YARDS, with the exception, that, in lieu of being secured by staples, *eye-bolts* are used,‡ which allows a space

* One standing part is placed *outside* of the thimble on the yard, and the other *inside*. This is done to avoid chafe, by crossing them, which otherwise would be inevitable. The cross-jack yard, however, has but one truss, and consequently a single strap.

† Necessarily so, for otherwise the parts would *cross* and chafe each other.

‡ Observing, however, before reeving them, to place the upper eye of the stirrups over the bolt, by which a seizing is saved, and the jack-stay made to serve the *purpose of a toggle*.

PLATE 50

Fig. 333

Fig. 334

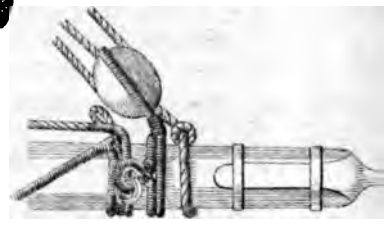


Fig. 335

Fig. 336

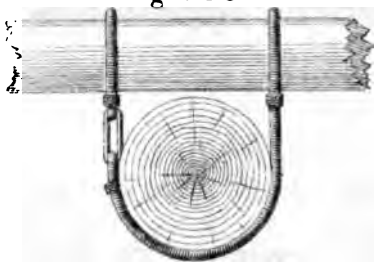
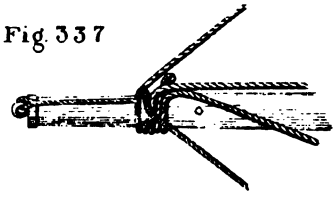


Fig. 337



between the jack-stay and yard, for the passage of the points in reefing. See Plate 32.

Foot-ropes. *Vide* TOPSAIL-YARDS—the only exception being that the inner ends in lieu of crossing abaft the mast, are connected to each other, in the slings, by a lashing *underneath* the yard, and this is seized up to the span of the topsail sheet-blocks, or to the arm of the patent truss.

Brace-blocks, Fig. 335, Plate 50 (where the block is itself omitted to avoid confusion). *Vide* TOPSAIL-YARDS.

In merchant and store ships, the brace-block is fitted with a long pendant, which hooks to the shoulder-band.

Lifts. In heavy ships the lifts are double, and reeve through single blocks, fitted with grommet-straps, Fig. 334, Plate 50, (which are wormed and served), going over the yard-arm outside, and last of all; the standing part securing with a hook, to an eye-bolt in an iron crescent extending across the lower cap, while the other part is rove through a single block at the cap, and thence to the deck, where a block is spliced into the end, or attached by means of a hook and thimble.

The block at the cap may be double and the standing part go with a running eye over the yard-arm, or hook to a becket in the strap of the block on the yard-arm. See Plate 32.

See that the carpenters and blacksmiths have attached all the necessary appendages to the yard, as cleats, boom-irons, &c., and send the chain-slings up by one of the top-burtons, fitting them over the lower cap in a score usually cut for that purpose, and securing the two parts by a back-lashing abaft the mast-head. Pass a stout strap around each quarter of the yard, near the sling-band, and hook the lower blocks of the pendant-tackles to them—the upper ones being shifted to a heavy strap over and around the lower cap; hook, also, both top-burtons to the burton-straps on the yard, and reeve the braces. (*Vide* RUNNING-RIGGING.) Reeve and man the lifts, and sway aloft, keeping the yard clear of the lower-mast by a fore-and-aft tackle. Now, when high enough, key the truss, hook the slings, unhook the pendant-tackles, burtons, &c., and square the yard by the lifts and braces.

The lifts are only rove single until the yard is aloft.

This routine hardly answers for the cross-jack yard, there being necessarily many exceptions; among which, we may note the omission of jack-stays, clew-garnet, and slab-line blocks, as also rolling-tackle, head-earing, and burton-straps. It should be remarked, too, that the brace-straps, in lieu of going on after the

foot-ropes, are secured by a rose-seizing *inside* of the shoulders, about one sixth of the length of the yard-arm, having the breech of the block to rest against the forward side. This is done to obviate the tendency it has to slip off, arising from the sharp angle which the yard and brace form with each other, when close-hauled.

The lower yard is sometimes taken first in order, in rigging ship, but by sending the topsail-yards up first, time may be saved.

Whiskers. These consisted formerly of two gaffs—one on each side of the bowsprit, fitted with jaws, or hooks, like the dolphin-striker; and when compared with the old-fashioned spritsail-yard, are much simpler, and more frequently preferred; for reason of the little trouble they occasion at sea, by rendering the operation of "canting" unnecessary.

Sway the whiskers on board with a tackle on one of the forward swifters, and land them on the forecastle, with the small ends resting on the head-rail, at each side of the bowsprit. Rack the topmast-stays in the bees (in order not to disturb the position of the mast) before coming up, and reeve the ends through their respective holes in the jaws, taking the precaution to leather them, on account of chafe. Then, with the assistance of a jigger, from each fore-topmast stay, hooked to a strap around each whisker (at the distance of about one third from the outer end), sway them out, until far enough to rig; and put over the *jib-guys*, which should be fitted with a cut-splice, made to set exactly, and so placed as to keep the whiskers perfectly square with each other. These splices are served, and covered with canvas. Now reeve the flying-jib-guys (protected by leather at their points of contact), through the holes bored in the whiskers for that purpose, and prepare to get them into their places—observing to have the bowsprit coppered in the wake of the ends—employing jiggers from the cap, hooked to straps around each jaw. With these rouse them forward, slacking the stay-jiggers (which, in this case, will serve the purpose of lifts, until they are secure), and hauling on the jib-guys, in order to bring the whiskers athwartship. Lastly, pass the jaw-lashing, put over the *jumper-brace* and *standing-part of forward lower boom-guy*, then set up the ends of the topmast-stays and the jib, and flying-jib-guys, and take off the jiggers.

This description refers to the old-fashioned whisker, Plate 42.

The jumper is fitted with an eye to go snugly over the whisker end, leads down through a clump-block strapped to an eye-bolt in the cut-water, thence to the head, where it is secured.

PLATE 51 A

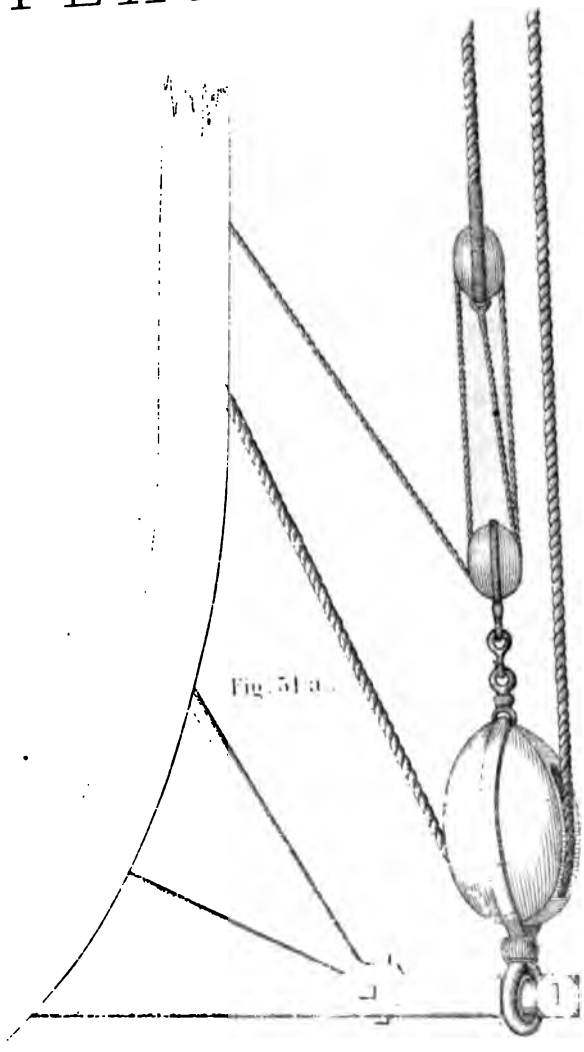


Fig. 51 a.

MAIN BRACE OF A FIRST RATE

RIGGING SHIP.

NOTE. *When preparing for sea*, slack the guys (which must be set up again when the jumpers are secured), and get the outer ends of the whiskers down to an angle of about 20° with the horizon.

It may not be altogether amiss here to add that *squaring* the whiskers in *port*, may be done by simply clapping on the *guys* and slacking the jumpers.

Whiskers go now with hooks, and hook to eye-bolts in the bowsprit; and the guys are in two parts, the forward and after-guys, or fitted as already described, under the head of Fitting Rigging. The other rigging is the same.

Top-gallant Yards. Having brought the yard *alongside*, sway it on board with the yard-rope, rove through the sheave-hole in the top-gallant mast-head, by bending it on to the slings, and stopping it down to the forward yard-arm. Sway on board, place it in the gang-way on chocks, unbend the yard-rope, and prepare to place the rigging on in the following order:

Slings. These are now fitted of iron, but when of rope, are made as in Fig. 338, Plate 51.

Parrel, Fig. 336, Plate 50. This is the best when formed of single grommet-straps (a long and short one), going over the yard, on each side of slings, at a distance apart equal to the diameter of the top-gallant-mast, and cleated, to prevent slipping. They are made to fit snugly, by means of round seizings passed close to the yard on the after-part, leaving a surplus bight to each, which forms the lashing-eyes—that of the larger strap (marled together and leathered), being long enough to go around the mast, and meet the short one (leathered also), where it is secured by a lashing of small-sized seizing-stuff, after the yard is crossed.

Jaws are frequently put on the top-gallant and royal-yards, and have been found to answer every purpose; there being, however, a necessity for care in sending them up or down, lest the curve or shoulder of the jaw should be knocked off.

Quarter Blocks. These are double, and almost invariably iron-strapped, connecting with a hook to a band on the yard. This is by far the best plan, as it saves trouble in sending the yard up or down. When rope is used, the blocks are single-strapped, with spliced eyes going around the quarters, and secured by rose-seizings on top.

Strap and Thimble, Fig. 338, Plate 51, for the lizard, called *quarter-strap*. See rolling strap, also *Topsail-yards*.

Strap and Thimble for rolling-*rope*. *Vide* TOPSAIL-YARDS. This is omitted by many seamen, who deem it unnecessary, and send the yard down, when the sail is taken in. But it would be well to remember, that if it be kept aloft, and the rolling-ropes passed securely over the topmast-cap, a considerable degree of support might be given to the top-gallant mast, as the yard-arms thus act the part of out-riggers, and the lifts perform the service of shrouds. As the quarter-strap answers for a rolling-strap, the latter is dispensed with.

Strap and Thimble for head-earing. *Vide* TOPSAIL-YARDS, or worked cringle-fashion to eye of foot-rope, a very neat plan and generally adopted.

Foot-ropes, Figs. 337, 338. *Vide* TOPSAIL-YARDS. The inner ends, however, do not cross abaft the mast after the yard is sent up, but seize to the opposite quarters.

Lift, Fig. 337, Plate 50. This is single with a round eye (the splice of which is served), going over the yard-arm (when swayed up for crossing), and generally leathered to make it slip readily, off and on, as the case may be. It is cut of sufficient length to reach the top after reeving through the bull's-eye, or metal roller, between the top-gallant shrouds, and marled to the brace in order to go on and off together.

Braces. When fitted double, a single block is strapped into a grommet, which is wormed and leathered, and sets snugly over the yard-arm when swayed aloft. In this way it is marled to the eye of the lift, or it may be fitted with a whip and long pendant, the eye of the latter being marled to that of the lift.

Splice the *snorters*, Fig. 337, Plate 50 (which are cut about half the length of the yard-arm, and simply whipped at the end) into the thimble of an eye-bolt at the yard-arm, hitching it to the quarter-strap ; and prepare for crossing.

To Cross Topgallant-Yards. The yard-rope, having a lizard attached (overhauled down forward, and outside of all), is rove through a good-sized grommet passed over the (upper) yard-arm and hooked to the link in the sling-band ; or, as in the case of a yard fitted on board ship, bent to the strap around the slings of the yard as in Fig. 338 ; the lizard being rove through the (upper) quarter-strap thimble, and hitched to the one on the opposite quarter. Take the eye of the lower lift, and brace in the topmast rigging, and that of the upper one to the opposite side of the cross-trees, and sway aloft. When the upper yard-arm rises above the heel of the top-gallant-mast, take off the grommet—slip on the lifts and braces, over the snorters, gathering up the slack of the lower one, and sway away, until the

TRYSAIL MASTS, ETC.

slings of the yard are over the topmast cap: then take a turn of the parrel-lashing abaft the mast, through the eye in the opposite strap, tend the lifts and braces, slack up the lizard, and "sway across," squaring the yard, and passing the parrel for a full due.

NOTE. The outer ends of snorters are generally plaited like sennit, that they may lie flat, and permit the eye of the lift and brace to fit over snugly.

Royal Yards. The routine of rigging and crossing is precisely similar to that of the top-gallant yards—the only difference being that the quarter-blocks are single.

In many ships, when at sea, small hand-grommets are worked around the jack-stays for the men to hold on by.

The jack-stays of the light yards are of iron and consequently have been omitted in the foregoing description.

TRYSAIL MASTS—GAFFS AND BOOMS.

These spars are usually swayed on board by means of the fore or main yard and stay-tackles—purchases most frequently in use, and convenient at this stage of the equipment.

Trysail Masts. Over several new methods, contrived with a view to extreme neatness, a preference is given to the old trysail-mast, which is shipped by means of a tackle hooked to a strap above the futtock-band; the head being pointed through a hole in the after-chock, and the heel (over which the hanks are passed) stepped in a socket, or mortise, on the fife-rail, or shoulder, bolted to the lower mast, just above the deck; after which, the head is secured by a lashing through a B-cleat underneath the top, or with iron keys; copper having been put on, in the wake of the gaff.

Gaffs. These are fitted in a variety of ways—having jaws, with a trysail mast; stationary, and secured to the lower mast by means of eye-bolts within each other (like lock-thimbles), when a batten or jack-stay is used, or with a sliding-chock, when fitted "railway fashion." The introduction of iron has done away with much of the gear incident to gaffs in former times; and the *vangs* and halliards are about all now that falls within the province of the rigger—the brail-blocks being superseded by sheaves (for that purpose) in cheeks fitted by the carpenters at each side of the gaff; while the blocks for the throat and peak halliards are iron-strapped, and connected to bands with eye-bolts. The vangs are best when fitted with a cuckold's neck, which is wormed and covered with canvas, having a neat seizing

at each side, and cleated both forward and aft, to prevent slipping. The gaff is sent up by the halliards, and the jaw-rope passed, or the eye-bolts riveted, as the case may be.

The plan of fitting spankers to work on the gaff, by means of hoops, has been generally adopted throughout the service.

A very important part of the fitting of a gaff is the saddle (a), Fig. 339, Plate 51. This consists of a block of wood, which bolts in between the jaws and is hollowed out to fit the mast. It facilitates the hoisting of the gaff, for at whatever angle it may be, the same smooth surface of the saddle is presented to the mast.

These are particularly useful in small vessels where the gaff is frequently lowered and hoisted.

The *spanker*-gaff should always be fitted with throat and peak halliards to hoist and lower, as necessary; for otherwise it would be almost impossible to reef the sail. In brigantines and schooners, it is not unfrequently the case that eye-bolts are attached to each side of the jaws, for preventer lashings in heavy weather; and a single block (grommet-strapped) is put over the gaff-end for a down-haul; vangs being dispensed with as useless, on account of the sharp angle at which they act, in consequence of the height of the gaff.

Booms. That for the *spanker* is neatest if shipped with a goose-neck to an eye-bolt on the mizzen-mast, and fitted with an iron band over the boom-end for the topping-lift (when single), and the guys, both of which connect to it with sister-hooks. The *sheet-blocks* are best if strapped with rope-grommets, on account of the jerks and checks in jibbing, which render eye-bolts liable to snap and break at the neck. The *foot-ropes* are formed with round-eyes (wormed and served) going over the boom-end, and seizing to staples inside of the taffrail.

The topping-lifts (one on each side) are usually fitted with sister-hooks in the end and hook to an iron span, about one fifth of the extreme length of the boom from the outer end; while the running parts reeve through blocks at each side of the mizzen tressle-trees, and thence to the deck, where gun-tackle purchases are attached. In men-of-war of the smaller class, and in the merchant service, the topping-lift is not unfrequently single, and rove through the gaff-end, and a roller in the after-part of the mizzen-topmast tressle-trees, having a jigger connected to it, by means of a hook and thimble.

The *sheets and guys* are best if rove in *one*, which may be done, by either having the standing-part over the boom-end, or *attached* to the blocks at the quarters. (*Vide* RUNNING RIGGING.)

PLATE 51 B

Fig 338

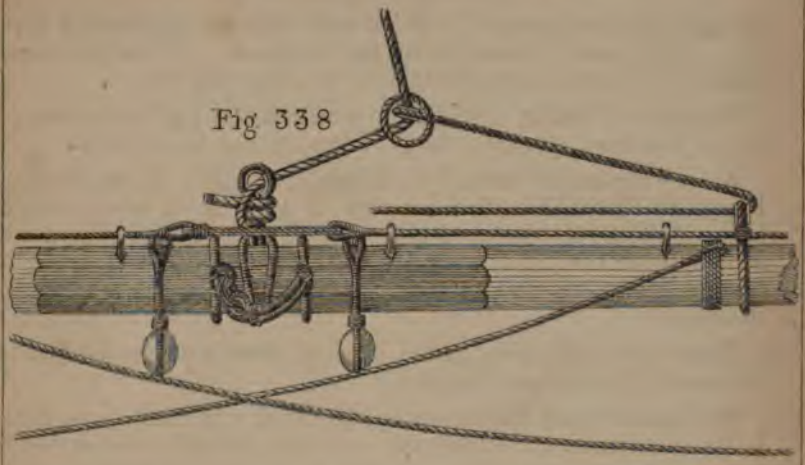


Fig. 339

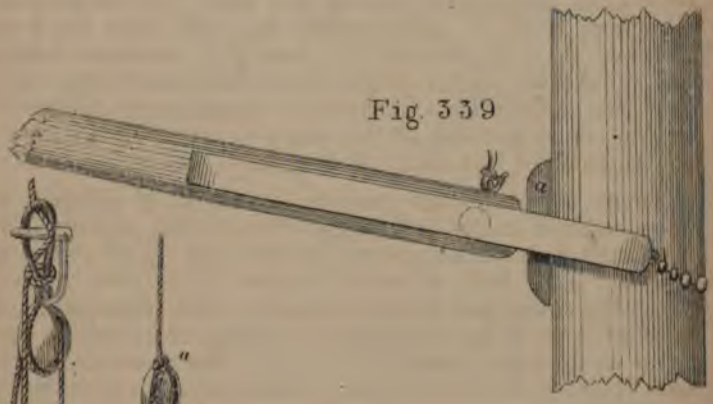


Fig. 340

The *out-haul* going around the boom with an eye, is rove through a block on the clew of the sail, and sheave in the boom, and should be of *hide-tailed* rope, which is far better calculated than hemp to stand the wear and tear, and friction of constant use.

On the *main-boom* of brigantines and schooners, the topping-lift is usually fitted with the standing part secured at the main-mast-head by a hook in an eye-bolt of the wythe; while the lower end is spliced around a double block, in which a fall is rove, leading through a single one, and a sheave in the boom. In this class of vessels, no out-haul is used—the clew of the sail shackling to a band around the boom. A heavy strap (which is cleated forward), with thimbles at each side, is put around the boom at the sheet-block for the boom-tackle pendant, which is fitted with a hook in the after-end and a thimble in the forward, and used only in going large.

The *crotch-ropes* (an essential requisite in the management of a boom-mainsail) are usually served all the way, and fitted with a hook in one end for a stout eye-bolt in the quarters—the boom being protected by copper in the wake of them, just forward of the sheet-blocks, which should be double-strapped with rope. These, with the addition of belaying cleats for the topping-lift fall and reef pendant (fitted of hide-rope, and reeving through a sheave in the boom, with a jigger attached), complete the equipments. The boom is then got in its place by means of the *throat*-halliards and topping-lift, assisted by guys and athwart-ship tackles, as requisite.

Studding-sail Booms. That for the *lower* studding-sail is fitted with an iron goose-neck and key, which connects to a bolt in the forward part of the fore channels, and is shipped either by means of the fore and main yard-tackles, or with burtons on the back-stay and forward swifter of the fore-rigging. On the outer end, about two thirds from the goose-neck, an iron band is put over the boom, having eye-bolts on the forward, upper, and after sides, for the topping-lift, and the guy-blocks; *mooring* pendants with large thimbles in the lower ends for the boats, and a Jacob's ladder are attached, by lashings like those used in securing the foot-ropes on the topsail-yard. These, with the *topping-lift* and the *out-haul block*, double-strapped with rope, having an eye to set taut over the boom-end, constitute all the *standing* gear, except perhaps the *lizard*, the thimble of which traverses on the topping-lift, and is used as a fair-leader at the outer quarter of the fore yard in getting the boom out or in.

By the old method the topping-lift hooks to the boom, leads up through a clump-block seized in between two of the fore

shrouds (like the sister-block in the topmast-rigging), down inside where it has a double block turned in, and a fall rove between it and a single one on deck.

On board of the majority of ships, it now leads up through a metal block on the fore yard-arm, through a block at the lower cap and thence on deck, with the purchase as before.

When the boom is not in use, it is hauled alongside by the after-guy, and rests in cranes, shipped for the purpose in the waist, the topping-lift being stopped down by the forward swifter.

The lower boom is so called at sea, and frequently the *swinging*-boom in port.

Topmast Studding-sail Boom. The frequency of accident to *topmast studding-sail booms* at sea, often renders "shifting" a necessary operation, and this consideration is deemed sufficient to recommend the fitting of both extremities alike, viz. :—tapering with a score and hole for the heel-lashing, that in the outer end (while in use as such), being "plugged" with wood, which can be readily driven out in case of a necessity for a "shift."* Through the hole in the inner extremity, reeve the *heel-rope*, turn a Matthew Walker knot in one end, and whip the other; unclamp the irons on the yard, and prepare for sending the boom aloft. Hook one of the top-burtons or a clew-jigger to the lower lift, somewhat more than halfway down, and send the fall to the deck "before all," attaching the lower block to a bight formed by hitching the heel-rope over the boom, and stop the standing-part down towards the outer end. Bend a hauling-line from the slings of the yard, on to the heel, and sway aloft, pulling up steadily on both, until high enough. Then pass slip-ropes over it; point it fair through the boom-iron, and rouse on the burton, cutting the stops as requisite, until sufficiently far to place the *lower studding-sail halliard-block*, and that for the *tack*, over, fitted with straps setting tautly around the boom-end, and kept from slipping in by an iron pin passed inside of both. After which, clamp the quarter-irons; hook the boom tricing-line; rig out to the square mark, and take off the burton, tripping-line and slip-ropes. Lastly, seize a hook horizontally on

* Should this plan of fitting the boom not be preferred, and it becomes necessary to shift it to the opposite yard-arm, for use, it may be done as follows :—Unclamp the boom-irons, and rig in, until clear of the "pacific," taking off the blocks at the end, and changing them to the other side, ready for placing over when the boom is transferred. Trice the heel up to the lower-stay collar (securing it there with the lashing), and lower the outer end down by means of the topmast studding-sail halliards, rousing it up on the opposite yard by the other halliards, overhauled down outside of all for that purpose. Then slack the heel-lashing, rig out, put over the blocks, clamp the irons, &c.

the yard at the "rig-out mark," with the point out-board, for the purpose of securing the boom, when setting the sail,* and fit the in-and-out jigger ready for use.

The Top-gallant Studding-sail Booms are rigged nearly in the same manner, with the exception of having no halliard-block at the outer end, or score in the heel; and in lieu of being retained on the yard by quarter-irons, it is usually (and best) made to traverse on a rope jack-stay, which is seized to the eye of the topsail-lift, and sets up to its opposite in the slings of the yard.

The *tricing-line* leads from the top up through a single block seized to the forward swifter of the topmast rigging, close up to the eyes, thence down to the boom, where it is rove through a single block (which plays freely on the line), and is then secured to the heel of the boom. When it is required to rig the boom out, the tricing-line is converted into an *in-and-out jigger*, thus:—The tricing-line is let go in the top, and the single block, through which it passes at the heel of the boom, is taken out on the yard, taking out the bight of the tricing-line with it, and hooks to a thimble on the yard.

The boom (fitted with a becket in the heel), then toggles to a travelling thimble on the jack-stay; and when required for setting the sail, is secured by means of a lashing passed over a hook on the yard, like that for the topmast studding-sail boom, already mentioned.

The booms on the topsail-yard are usually sent up by the halliards, rove through a block, secured to the forward-swifter of the topmast-rigging, and the boom slung in a span. For the manner of reeving the gear, *vide* RUNNING-RIGGING.

Besides enabling us to measure for and cut standing rigging, a fore-and-aft draft of the ship gives the length of all running rigging. To measure for main-topsail clew-lines, for example, supposing them to go double, take twice the distance from the clew of the main-topsail, Fig. 277, Plate 35, to the quarter-block on the topsail-yard, to which add the distance thence to the deck, plus end enough to lead out; double this to get the other clew-line and divide by six to reduce it to fathoms, and so for any other rope. One half of each upper yard should be represented as on the cap, in order to measure for lifts, &c.

* The heel-lashing is passed over the hook, and back through the score in the boom, and two half-hitches taken with the end around all parts.

RUNNING RIGGING.

When a rope leads direct and is not exposed to unnecessary friction it is said to have a clear or a *fair lead*, an extremely desirable condition and one too frequently neglected.

In the fitting of running gear there are two essential observances; economy and an assimilation in size between the ropes and blocks, both of which may be attained by the following rule laid down by Glascock, who says it "is not recommended to *cut* and reeve, but, on the contrary, to *reeve* and cut." Having stretched the rigging (first "thorough footing" it, *i. e.*, passing the end through the coil), by taking it to the capstan, commence reeving it in the order of its importance, in which we may "reckon," as first,

BRACES.

Fore-Braces. The standing parts are rove through holes in the fore-part of the main-bibbs (having overhand or Mathew Walker knots in the ends); through the blocks on the yard (from *in out*), thence back through others on the outside of the bibbs, and down to the sheaves in the fife-rail (usually from *aft forward*).

Main-Braces. The standing parts are clinched, or fitted with running eyes, over the bumpkins aft—then rove through the brace blocks from *out in*, back to others, on the bumpkin (*inside* of the standing parts), and through sheaves in the bulwarks.

On board large ships where there is much drift to the main brace it will be found very convenient to fit the standing part with a jigger thus: Into the end of the brace splice a single block, and to the becket in the strap of the brace-block on the bumpkin, hook the double block of a jigger. Reeve the fall, the hauling part leading in through the bulwarks with the hauling part of the main brace. After hauling the main-brace moderately taut in the usual way a few hands on the jigger fall on the standing part will get the brace as taut as desirable.*

It is usual to have a permanent timenoguy leading from the mizzen rigging to the main-brace, the object being to keep the bight of the brace from fouling the quarter-davits while working ship.

The same has been found needful on board very long ships, in the main rigging to avoid fouling the waist davits.

The timenoguy is seized to the standing part of the brace, the hauling part reeving through a thimble.

* The same principle may be variously applied, as to a main-tack, the sheet of a schooner's lug foresail, &c. (See fore-sheet of "America.")

RUNNING RIGGING.

Cross-jack Braces. The standing parts are spliced into the strap of a *double* block* hooked to an eye-bolt on each side of the mainmast, in a line with the yard†—thence to the brace-blocks from *out in*, and back to the inner sheaves of those on the mainmast.

Fore-topsail Braces. The standing parts are hitched, or spliced together above the eyes of the main-topmast rigging, seized to the collar of the stay and stopped down on each side as far as the crotch (to avoid chafe from the foot of the top-gallant-sail); thence forward, and *down* through the brace-blocks to clump-blocks seized to main-stay at the fork, and thence through blocks at the bibbs to the main fife-rail.

Main-topsail Braces. The standing parts are hitched to the mizzen-topmast-head, and seized to the stay-collar; thence rove to the yard, and down to span-blocks on the mizzen-mast, about halfway between the top and deck. In many ships, the standing parts are secured to an iron band which travels up and down the mizzen-topmast with the parrel, in order to shift the strain lower down, as it becomes greater, and sail is reduced, or the standing part may lead through thimbles at mizzen topmast-head, and secure in the mizzen chains, thus relieving the mizzen-topmast of much strain.

Mizzen-topsail Braces. The standing parts are secured to the strap of a block at each side of the main cap; thence to the yard, back to the blocks, and so down through the lubber's-hole to the deck.

Fore-top-gallant Braces are usually rove single, the standing parts going over the yard-arms with the lifts, thence through leading blocks on the main-topmast-stay collar, and others, under the eyes of the topmast rigging—whips (the standing parts of which are secured to the lower tressle-trees) being attached to the ends, in large ships. The whip blocks should be iron bound with swivel-eyes.

Main-top-gallant Braces. *Vide* preceding, and substitute *mizzen* for "main."

Mizzen-top-gallant Braces. Through the inner sheaves of small double blocks, underneath the main-topmast cross-trees—the outer sheaves being used for the bowlines.

Fore-royal Braces are single (without whips), and rove like the top-gallant braces, except that they are taken to the main-

* The outer sheave is for the mizzen top-bowline.

† Otherwise, the angular action of the brace would cant the yard either up or down, and consequently slack one or the other of the mizzen-topsail leeches.

top-gallant mast-head and stay. The blocks are now generally made of metal, and hook to eyes in the funnel, or are seized to the top-gallant rigging.

Main-royal Braces. Same as fore-royal braces, except taken to *mizzen*-top-gallant mast-head, and through blocks on the stays.

Mizzen-royal Braces. Single, and through middle sheaves in the after-chock of the main-topmast cross-trees.

Topmast Studding-sail-boom Braces may be either single, going over the boom-end with a running-eye and leading through a tail-block on the forward swifter of the main rigging; or double, with a pendant and whip leading to the main rigging.

Preventer Braces are fitted with a *pendant* and *whip*, the former going round the yard, hooking to its own part, and the latter led to the deck, well aft, when for bad weather. When rove for action, they are led forward.

HALLIARDS.

Topsail-Halliards. Where double-tyes and gins are used, the standing part of the halliards is spliced to a single block (which is iron-strapped and fitted with a swivel), in the channels, on each side, and then rove through a double one hooked to a thimble in the end of its respective tye.

Top-gallant Halliards. On board of first and second rates, the old plan was to have a regular tye and runner. The best method is to have a tackle hooked to a bolt in the lower tresse-trees, and the upper block fitted with two lizard-tails, which tail on to the yard-rope, just below the eyes of the topmast rigging, the hauling part of the purchase being sent through the lubber's-hole to the deck, and the surplus end of the yard-rope flemished down snugly in the top.

In this case the yard-rope becomes the tye.

Royal-Halliards are best, if fitted with a gun-tackle purchase, thus: The yard-rope, being rove in a leader on deck, is passed through a single block (fitted with a strap having an eye), and toggled on at some distance above the bulwarks, as represented in Fig. 340 (a), Plate 51. In the event, then, of having to send the yard down, it is only necessary to take off the block, which will leave the yard-rope clear for running.

The strap of the block may be a temporary one and made of a selvagee and the yard-rope, Fig. 340 (a), or it may be made of the yard-rope alone by using a marling-spike hitch.

These and the top-gallant halliards are used only at sea.

Throat-Halliards. If for a spanker, or trysail, they usually consist of a purchase rove through double and single blocks; the former hooked to a bolt on the under side of the after-lower-chock, and the latter to a band and eye-bolt on the inner end of the gaff; the hauling part leading through the upper block from *aft forward*, to the deck. In brigantines, and vessels with a boom-mainsail, both blocks are double.

Peak-Halliards. The best plan for peak-halliards is to reeve them as follows: Splice the standing part into the breech of the mast-head block (which is double), and reeve thence through the *inner* block of the gaff, from *aft forward;* then up through the *port* sheave of the mast-head block, out through the block at the gaff-end, from *forward aft;* and lastly, back to the sheave of the mast-head block.

The merit of this system will be apparent, if we consider that the hauling part, by being rove *last*, at the gaff-end, permits the peak to drop the instant the halliards are let go.

The standing part may be rove through the *third* sheave of the block (treble), at mast-head, and have a small single block spliced in the end, through which reeve a whip; this enables the peak to be pulled up taut. The latter plan is adopted by all large schooners and sloops, and is on the same principle as applying a purchase to the standing part of the main brace.

Storm-staysail Halliards. The fore-storm staysail-stay, fitted of rope of the proper size, having in its upper end a stout iron toggle covered with leather, toggles into the crotch of the fore-stay. The lower end, after passing through the hanks of the sail, reeves through a stout thimble strapped to the bowsprit and sets up with a luff. The halliards are sometimes a luff, and sometimes a gun-tackle purchase. The lower block hooks to the head-cringle of the sail, the upper to an eye-bolt under the top, or to a strap around the collar of the fore-stay.

This gear is rove only on the probabilities of bad weather.

Jib and Topmast-staysail Halliards may be rove through the upper sheave of iron fiddle-blocks, hooked to a bolt in each side of the topmast tressle-trees—the former double, through a block on the head of the sail, with the standing part lashed to the crotch of the stay collar; and the latter single, with sister-hooks to the head-cringle, and a whip, the block of which comes just below the eyes of the rigging, when the sail is taken in. In shifting topmasts, or in performing any other necessary evolution touching these ropes, the blocks only require to be

unhooked while the lower sheaves serve for the topsail buntlines.

The jib-halliards should be led on the *starboard* side, and those for the staysail on the port—a rule which is self-evident, when we remember that the latter is set on the *port* topmast-stay. The method of fitting these halliards with *whips*, is not approved of by seamen generally, on account of the liability to tangle and get foul in hauling down the sail; and the obvious necessity of separating the parts widely from each other.

NOTE. Whenever a whip is used, as in the foregoing, it is well to use an iron-strapped swivel-block splicing the pendant into the eye of the swivel to avoid cable-laying.

Flying-jib Halliards are rove single, through a neat block secured at the hounds of the top-gallant-mast (on the *port* side),* under the eyes of the rigging, and connected to the head-cringle on the sail by means of sister-hooks. In large ships, however, they are sometimes rove double, and the standing part seized to the splice of the stay on the *under* side. Frequently there is an iron eye made on the lower rim of the funnel, to which hook small iron fiddle-blocks for flying-jib halliards, top-gallant buntlines, and top-gallant bunt-jigger, Fig. 327, Plate 48.

Gaff-topsail Halliards are single, and in barks and ships, are rove through a sheave in the top-gallant mast-head, and attached to the yard with a *fisherman's bend*; or if the sail is triangular in shape, to the head-cringle, with a *sheet-bend*. On board of schooners and hermaphrodite brigs, they are rove through a sheave in the *topmast*-head.

Lower Studding-sail Halliards. The *outer halliards* reeve through the lower sheave of a fiddle-block, which is strapped with a long pendant, and hooks to a strap around the topmast-head above the eyes of the rigging; thence to the halliard-block at the end of the topmast studding-sail-boom, and attached to the yard with a fisherman's bend, or a studding-sail halliard-bend. The upper sheave of the fiddle-block is for the topmast studding-sail-boom topping-lift, when one is used. Or they are rove through a span-block on each side, which is secured with lashing-eyes *above* the topmast rigging, and forward of the shrouds, the hoisting part leading on deck through the cross-trees and the lubber's-hole. The *inner* halliards are usually formed out of the fore clew-jigger, hooked to the inner head-cringle of the sail,

* In the absence of the metal blocks which hook to the funnel, a block precisely similar to this one is lashed on the starboard side, for the top-gallant buntline.

and a strap around the forward bull's-eye in the top-rim, or other convenient place.

Topmast Studding-sail Halliards are rove on each side through a single block, the span of which is passed over (and seized together under) the topmast cap between the doublings of the mast, being sufficiently long to reach forward to the top-gallant shrouds; thence *abaft* the topsail-yard, through the jewel-block, and so to the deck, where they are attached to the central part of the studding-sail yard with a fisherman's or studding-sail halliard bend.

By Plate 32, the halliard-block may hook to the link in the crescent on the topmast cap.

Top-gallant Studding-sail Halliards are rove on each side, through a single block (which is fitted with a rope-strap and tail), hitched above the eyes of the top-gallant rigging; thence *abaft*, to the jewel-block, and so to the top, where they are bent to the studding-sail yard, in the same manner as the halliards previously mentioned, the hoisting-part being sent down *between* the horns of the cross-trees, to the deck abaft, and clear of all.

The halliard-blocks at the mast-head are much neater when fitted with lashing-eyes.

SHEETS.

Fore and Main Sheets. The standing parts are connected to eye-bolts on the outside of the bulwarks with sister-hooks, just *forward* of the sheaves for the hauling parts; thence, they are rove *up* through the blocks at the clews of the sail, and back, inboard through the bulwark sheaves.

Topsail Sheets. When double, as on board of first-rates, the standing parts are fitted with running-eyes, which go around the yard-arms *outside* of all, and thence rove from *out in*, through the sheet-blocks to the yard sheaves, and the quarter-blocks in the slings; being led, lastly, to the bitts on deck, forward of the mast. If single, they are simply secured to the clew-cringle with *inside* clinches; but where chain is used, they are connected by small stout iron shackles. On board of *polaccas* (a class of vessels peculiar to the Mediterranean), topsail-sheets are not used, and the clews of the sails are lashed to the large beckets on the lower yards, fitted for that purpose.

Topsail-sheets, when not chain, are always tailed with hide rope.

Top-gallant and Royal Sheets are always single, and bent to the clews of their respective sails. The former are rove through

the topsail-yards, to the *after*-sheaves* of the quarter-blocks, thence they are led through the lubber's-hole to the deck. The latter are rove in the same way, except through the sheaves and quarter-blocks of the top-gallant yards, and thence through thimbles on the futtock-staffs of the topmast rigging (abreast of the *second* shrouds), to the top or deck, as may be preferred. They are generally tailed with hide rope.

Storm-staysail Sheets are temporary purchases, and consist usually of stout luffs hooked (and moused) to the clew-cringles, and brought well aft, in order to form, as near as possible, a line with the foot of the sail. The hauling part should then lead from the *forward*-block, by which a greater purchase is obtained; although the reverse of this is advocated by many seamen, on account of the difficulty sometimes experienced in getting a turn with the belaying-end, in consequence of the flapping of the sail; but this objection will be entirely overcome, if the sheet be hauled aft, and the foot taut, before hoisting.

Trysail Sheets. The best plan for fitting these is to have a pendant attached to the clew of the sail for the sheet to hook into, as it saves the trouble of "lighting up" the blocks to hook and unhook in shifting the sheet, as in wearing ship, &c. The sheet is an ordinary luff and hooks well aft to an eye-bolt in the deck.

Jib and Topmast-staysail Sheets. Both of these are generally fitted with a whip and pendant, as follows:—The latter, which should be in length equal to about one third of the foot of its respective sail, is wormed and served; and after being middled, a good-sized thimble (around which the parts of the pendant are crossed), is turned in with a throat-seizing. It is then secured to the clew-cringle of the sail (in bending), with a stout lashing and the standing parts of the sheets, after being hooked or clinched, to an eye-bolt in each side of the bulwarks,† are rove from *out in*, through a single block spliced into each end of the pendant—the hauling parts leading in-board, on the forecastle, to belaying cleats.

NOTE. Both parts of the topmast-staysail sheets are secured *inside* of those for the jib.

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* In vessels where the quarter-blocks are *threefold*, the top-gallant-sheet is rove in the *middle* sheave.

† The position of the bolts and blocks (or sheaves) must be such, that the sheet when taut, shall form a line at right angles with the luff of the sail—for otherwise, either the foot or the leech would become slack, and the jib thus be deprived of a great portion of its efficacy. Head sheets should have a knot cast in the end to prevent unreeving, by accident, as in a squall.

RUNNING RIGGING.

Flying-jib Sheets, are single, and usually consist of one piece of rope, which is middled and fitted with a thimble (like the jib-pendants), and secured to the clew of the sail in the same manner. The parts are then led each side of the boom, in-board, through a thimble on the whiskers, and a fair-leader in the head-rail, to the forecastle.

Spanker Sheets, are rove in *one* with the guy. The standing parts are put over the outer extremity of the boom with a cut-splice eye, or connected separately with sister-hooks, and rove to the (double) block in each quarter; thence through the sheet-blocks on the boom from *forward aft*, and back to the second sheaves of the quarter-blocks.

Boom-mainsail Sheets. In small craft, as schooners, &c., a purchase of double-blocks, and working on a traveller, is used; but in larger vessels, two (attached by separate straps, and hooked to eye-bolts in each quarter) are employed to manage the boom—the hauling parts in either case leading from the upper block. This latter method is by far the better, as every one who has had to "jibe" a boom-mainsail, with a single sheet and crotch-ropes, in heavy weather, will bear witness to.

Gaff-topsail Sheets are formed of a single piece of rope, which is middled, and the bight passed through the clew-cringle of the sail; the ends being thrust also through the bight, are led down on each side of the gaff to a belaying cleat on the boom, near the jaws.

Studding-sail Sheets. Those for the *lower* studding-sail consist of a single piece of rope, passed through the inner clew-cringle like those for the gaff-topsail (or the two parts may be seized together), and in setting the sail, one sheet is rove from *forward aft*, through a thimble or block on the goose-neck, in order to bring the clew close down to the boom, and the other led inboard over the hammock-rail, on the forecastle, by which to haul on board the sail, when taking it in.

In fitting a *topmast* studding-sail, two sheets are also required, which are attached to the clew in the same manner as those for the lower studding-sail. One (called the *short sheet*), being passed *forward* of the topsail, and *aft* through a thimble (seized to the jack-stay or quarter iron) on the outer quarter of the lower yard, into the top, where it is belayed to a cleat; and the other, or *deck-sheet*, being led to the forecastle, *forward* of the yard. The sheets and down-haul are always made up with the sail.

RUNNING RIGGING.

The *top-gallant* studding-sail sheet is simply spliced into the clew of the sail (having parcelling on it for two or three feet below, to avoid chafe from the foot-rope of the topsail-yard), and led into the top, where it is hitched around the forward-swifter, or it may be led on deck, where it may be made of much service when taking the sail in, in a fresh breeze.

TACKS.

Fore and Main Tacks are rove double (except now and then on board of small vessels, where they are single), and fitted with the inner end tapering. The standing part, which is wormed and served for a fathom or so from the end (as a protection from wet), is clinched, or passed over the extremity of the bumpkin* with a running-eye, and rove through the tack-block at the clew of the sail—then back through a leading-block inside of the standing part, and a hole in the bulwarks.

Studding-sail Tacks are either bent to the clews of their respective sails with two half-hitches, or an inside-clinch, and rove from *in out*, through the blocks at the boom-ends. That for the *topmast* studding-sail being led aft, through a tail-block on the forward-swifter of the main-rigging; and the tack of the *top-gallant* studding-sail, through a leader strapped around the bull's-eye of the after topmast shroud.

NOTE. The double-block in the main rigging for the tack and boom-brace should not be tailed to the shrouds, as it hauls them out of line and stretches them unduly. It should rather hook to the eye of a long pendant, which hooks far enough aft in the main-chains to form a line with the tack, and passes through a *lizard* at the proper place in the main rigging.

Spanker and Boom-mainsail Tack (Lashings), are passed through the cringle (into which they are spliced), and an eye-bolt on the upper side of the boom.

NOTE. In laying-to, in a small vessel, under a balanced-reefed (boom) mainsail, the tack of the sail should be lashed up to the jaws of the gaff, and the whole hoisted several feet up the mast by means of the throat-halliards. In this way the sail is elevated to the wind above the waves, and in the event of being boarded by a quarter sea, it cannot lodge in the belly of the sail, but will pass between it and the boom.

* The *main* tack is secured to a bolt and block in each of the waterways, *forward of* the gangway, being rove like the fore, through the block on the clew of *the sail.*

RUNNING RIGGING.

Jib and Staysail Tack (Lashings) consist of a single piece of rope, spliced into the tack-cringle of the sail, and lashing it to the *stay*, around which it is passed, and the end hitched.

Latterly the jib-tack is fitted to shackle or hook to iron-work on the boom.

CLEWLINES.

Clew-garnets, are used only on the courses. The standing parts are taken around the yard and secured to their own part, rove through secret blocks at the clews of the sail; then back to their respective leading-blocks underneath the yard (*inside* of the standing parts), and lastly to the deck.

Sometimes the standing part of the clew-garnet is taken between the head of the sail and the yard, and seized to the arm of the truss. This is the better plan.

Topsail Clewlines, are fitted like the clew-garnets with secret blocks, and rove through the forward sheaves of the quarter-blocks, through the lubber's-hole to the deck. In many vessels, however, the method of a whip and pendant is preferred—the former (of *double* the sized rope for the ordinary clewline), being rove through the quarter-block, and attached to the clew-cringle with sister-hooks; while the parts of the whip (but *half* the size), reeving through a block spliced into the end of the pendant are led through the lubber's-hole to the deck, and separated widely from each other, on account of the liability to become "hawser-laid."

Top-gallant and Royal Clewlines, are both single, are bent to the clews of the sails, and rove through the quarter-blocks of their respective yards, and thence to the deck by way of the lubber's-hole. The royal clewlines do not usually extend below the top, being rove through fair-leaders on the topmast shrouds, alongside of the sheets.

Lower Studding-sail Clewlines, are simply bent to the clews, and reeve *abaft* the sail, through small single blocks on the inner end of each lower studding-sail yard, and thence are led inboard to a block hooked to the forward futtock-plate. They are frequently led through a glut in the belly of the sail.

Fore and Main Clew-jiggers each consists of a purchase of single blocks, hooked to the clews of the courses forward and to eye-bolts underneath the forward part of the tops. In furling sails, they are found very useful for rousing the clews and leeches up forward of the yard; while they also serve the purpose of *inner* halliards for the lower studding-sails, and are often em-

ployed as yard-arm jiggers in bending, or as reef-tackles in reefing.

Topsail Clew-jiggers. Like those for the courses these are temporary and used for clewing up the sail. They are found very convenient in taking the clews well up above, and forward of the yard, greatly facilitating the operation of furling. They are not hooked at sea but are generally sent up preparatory to going into port.

On board first-rates, they consist of two single blocks, the lower secret and strapped with a pendant, the upper block hooks at the topmast-head.

BUNTLINES.

Fore and Main Buntlines. The neatest and best plan for fitting these, in a large ship is as follows:—Through a *double* block hooked at each side of the lower cap, and through two short leaden pipes, inserted between the tressle-trees and pigeon-hole, reeve both ends of each buntline, from *aft*, down forward of the sail to the foot-rope, where they are connected by toggles; having the bight of the middle part (to which a single whip leading through the lubber's-hole to the deck is attached), abaft the block at the cap. The other is rove in a similar manner. But in small vessels, where single buntlines are used, the cap-blocks are single also, and *one* leg only, is toggled to the foot-rope of the sail, some distance out on each side of the midship seam. The advantage of this plan is, that it enables us to rouse the buntlines up *higher;* while the objection to fitting the *main* by this method consists in the fact of crowding too many ropes together —a principle which should never be lost sight of in the reeving of running gear.

NOTE. If it is deemed preferable to reeve the *main* buntlines, with the bight forward, through *shoe*-blocks between the stays, the tendency to become "cable-laid" can be obviated entirely, by having the *bunt-line* of *left*-hand rope, and the *whip* of *right*-hand.

Topsail Buntlines are generally single, and the *fore* rove through the *lower* sheaves of fiddle-blocks* under the eyes of the topmast rigging, thence forward through the thimbles of a span hitched around the breech of the tye-block, and down to the foot-rope of the sail, to which they toggle—the hauling part leading to the deck through the lubber's-hole.

*The *main* and *mizen* topsail buntlines reeve through cheek-sheaves in the fore-part of the upper tressle-trees, or treble blocks hooked to an eye-bolt in the heel of the top-gallant mast, the midship sheave being for the bunt-whip. This latter *plan, though* general in the service, cannot be recommended.

RUNNING RIGGING.

NOTE. In some instances the buntlines are fitted with whips, and are often spliced into short spans, which toggle to the foot of the sail, at each side of the midship seam.

Top-gallant Buntlines, lead through the blocks under the eyes of the top-gallant rigging and toggle to the foot of the sail, the hauling parts leading into the top.

They are sometimes connected by a span and thimble to the leech of the sail, so that when the sail is taken in, the leech is brought along the yard ready for furling.

In small vessels there is but one buntline. It is spliced to a thimble on a span both ends of which are toggled to the foot of the sail.

BOWLINES.

Fore-Bowlines, are simply toggled to the bridles, on the fore-sail, and lead inboard to the forecastle through blocks seized to the forestay straps, or strapped to eye-bolts on the bowsprit.

Main-Bowlines consist of a whip and runner—the latter reeving through the thimble in the bridle, and belayed to the fore fife-rail; and the former passing through a block in the end of the runner, led well forward—the standing part of the whip being secured to an eye-bolt at the fore fife-rail, and the reeving end over a pin.

In tacking, when it is required to let go the main bowline, the standing part of the *runner* is cast off, and the whole shifted to the opposite side, ready for reeving.

Top-Bowlines. The *fore* toggle to the bridles, and lead forward through blocks strapped to each side of the bowsprit-cap, and back, inboard, to the forecastle. The *main* reeve through single blocks, connected to bolts in the after rim of the fore-top, and thence to the deck; and the *mizzen*, through the outer sheaves of the brace-blocks on the mainmast.

Top-gallant Bowlines.* The *fore* reeve through blocks seized to the jib-guys, and thence inboard to the forecastle. The *main* through the outside sheaves in the after-deck of the fore-topmast cross-trees; and the *mizzen*, through the outer sheaves of their respective brace-blocks, to the deck.

Royal-Bowlines.* The *fore* after being toggled to a *becket* on the leeches of the sail, are rove through thimbles on the flying-jib guys, and thence inboard to the forecastle. The *main* are rove through thimbles seized to the after-part of the fore-top-

* Obsolescent.

gallant funnel, and led thence to the fore top; while the *mizzen* reeve through the outer sheaves in the after chock of the main-topmast cross-trees, and lead to the top also.

DOWN-HAULS.

Topmast Staysail, Jib, and Flying-Jib Downhauls, are each bent to the head cringle of their respective sails, and after being rove through the hanks, and a single block, seized to the nip of the stay, are then led inboard on the forecastle.

Studding-sail Down-hauls. That for the *topmast* studding-sail is bent to the outer end of the yard arm and rove thence through a thimble on the leech, to the down-haul block at the tack, leading on deck, forward of the foresail, across the forecastle to the opposite side. That for the *top-gallant* studding-sail is merely bent to the inner yard arm of the sail, and led abaft all to the top.

Gaff-topsail Downhaul (and Clewline) is led from the after clew of the sail (to which it is bent), through a single block at the head of the sail and thence through the hanks on the mast down to the deck.

OUT-HAULS.

Spanker Out-haul. *Vide* BOOMS.

Peak Out-haul consists of a whip and pendant. The latter is bent to the peak of the sail, rove through the sheave in the gaff, and at a distance equal to the length of the gaff, has a single block turned in, through which the whip is rove. The standing part of the whip is made fast under the top, the running part leads through a single block and thence on deck.

Lower Studding-sail Out-haul is clinched or connected by sister-hooks, to the outer clew of the sail, and led through a single block put over the boom with rope-strap, abaft, to a sheave above that for the guy in the bulwarks.

Gaff-topsail Outhaul is hitched to the clew of the sail, and rove through a sheave at the gaff-end, down to the deck, where it is belayed to a cleat on the boom.

Trysail Out-hauls are used only on board of those vessels where the trysails are set and taken in on the gaff. They are always single, and attached to the outer head-cringle of the sail, being rove through a sheave in the gaff-end to a leader strapped to the jaws, and having a whip, which is led thence to the deck. The *in-haul* is rove through the hanks on the head of the sail to a *single* block at the jaws also, but on the opposite side.

REEF-TACKLES.

Topsail Reef-tackles usually consist of a *hide* pendant, clinched to the cringle, on the leech of the sail below the close-reef-band, and lead upward through the *outer* yard-arm sheave, to the lower block of the reef-burton, which is hooked to a thimble spliced into the end of the pendant; the hauling part of the burton fall leading through the lubber's-hole to the deck.

Sometimes the reef-tackles are fitted thus: The standing part is spliced to the strap of a block toggled on the leech of the sail, below the close-reef band, thence led upward through the forward sheave of a double block on the yard-arm outside of all, down through the block on the leech, up to the remaining sheave of the double block, and so to the after sheave of the quarter block, and lastly through the lubber's-hole to the *side* rack on deck, or they may lead down through a block at the top rim. In the former case the quarter block is three-fold.

Fore and Main Reef-pendants are simply clinched to the cringle and rove through a block placed temporarily over the pacific iron, being hauled up by means of the clew-jigger hooked to a thimble in the end, and a strap around the forward futtock plate, or to the lower cap. The pendant, when not in use, should be stopped up to the head earing of the course.

Boom-mainsail Reef-tackle. *Vide* BOOMS.

LEECH-LINES.

These are mostly confined to the courses, and those on the *forward* side of the sail are clinched to the leech—*outer* one about one third down from the head-earing-cringle, and the inner one about two thirds—and thence rove up through leading blocks on the bending jack-stay* to the inner and outer sheaves (respectively) of a double block, strapped into the end of a long pendant, hooked at each side of the lower cap—the hauling part of the leech-line reeving through fair leaders on the lower rigging to the *side* rack, on deck. The *after* ones are clinched to the sail in like manner, and at the same points, but rove *abaft* through single blocks on the lower yard (corresponding with the position of those for the forward leech-lines), to double blocks at the slings, and thence on deck to the topsail-sheet bitts.

NOTE. In large ships they are sometimes temporarily rove on the topsail-yards (through tail-blocks on the forward swifters)

* These blocks should be so placed that the leech of the sails will be taut along the yard when hauled up; and fitted with straps, which permit them to hang about a foot below the yard—a plan obviating the necessity of attending the leech-lines in bracing up.

for furling sails, where the leeches are heavy, and clew-ropes are not used.

BRAILS.

Spanker and Trysail Brails are middled, and the bight secured to their respective eyelet-holes on the leech of the sail by cross-seizings—the *throat*-brails reeving through cheek-sheaves on the inner end of the gaff at each side, and the *foot*-brails through single blocks seized to the hanks on the trysail-mast.

Like leech-lines, brails are bent and rove so as to haul the leech of the sail, when brailed up, taut along the gaff from the peak to the throat.

When the spanker works on the gaff, it has in addition to the brails, a down-haul, for hauling the head of the sail down on the gaff, and a clew-line for taking the clew up to the throat.

Jib-brails* are fitted in the same manner, and led inboard, except being rove through single blocks secured at each side on the luff, and through leaders between the guys and boom. Jib-brails are scarcely ever used on account of their tendency to chafe the sail. A clew-rope, however, is very useful in lightening the clew over the stays when shifting over the sheet.

Slab-lines* are peculiar to the courses, and are spliced into a thimble on a span toggled to the foot rope at each side of the midship seam, and rove (abaft the sail) up through a single block, seized to the sling-band of the lower yard, or the span lashing of the quarter-blocks, and thence to the deck.

GUYS.

Lower-boom Guys. When double, the standing part of the forward one is put over the end of the whisker *after* the jumper-brace, and rove through a single block on the boom, and back to another bolted to the bowsprit-cap; the hauling part being led inboard to the forecastle. When single, they connect to the boom by sister-hooks, and the block is dispensed with. The *after* guys are rove in the same manner, except abaft to a bolt and sheave in each side of the bulwarks, just forward of the gangway.

Spanker-boom Guys. *Vide* SHEETS.

BUNT-JIGGERS.

Bunt-jiggers are used for the courses, topsails, and sometimes top-gallant sails. For the latter it is single; the first two consisting of a whip and a long pendant. The topsail bunt-jigger

* Obsolescent.

leads through the midship sheave of the treble block in the heel of the top-gallant mast, from *aft forward*, down forward of the topsail, under the foot and up abaft to the upper glut. The after end of the pendant has a single block (an iron-bound swivel) spliced in and a whip rove. The bunt-jiggers of the courses lead in the same way, through a single block under the top.

The top-gallant bunt-jiggers lead into the top. Bunt-jiggers are kept hooked in port, and at sea they are generally got up with the clew-jiggers, in anticipation of going into port.

REFERENCES TO FIGURE 341, PLATE 52.

Fig. 341 represents a topsail bent to the iron jackstay of a topsail yard; *a' a''* are the first and second reef-bands, fitted to reef with beckets and toggles on the yard; *a a* the third and fourth reef-bands with reef-points; *b b*, belly-bands—frequently there is but one; *c c*, leech linings; *d d*, foot lining or band; *e*, top lining; *f*, mast lining; *g*, buntline cloths; *h*, reef-tackle patches or bands; *t t*, head tabling and head holes through which the robands are passed; all these, with the exception of the top foot, and mast lining, are on the forward side of the sail.

The Gear. 1, the brace block; 2, 3, reef-tackle; 4, head-earing, leathered; 5, 6, 7, 8, the first, second, third and fourth, or close-reef cringle—the earing is spliced into the eyelet-hole below the cringle, seized to it and bent to the cringle above; 9, reef-tackle cringle; 10, bowline cringles, bowline bridle and toggle for bowline: 11, iron clew or spectacle—to two of its eyes splice the leech and foot-rope, the eye and splice being leathered—to the third eye shackles the topsail sheet-block; 12, 12, buntline toggles, between which the foot-rope is leather; 13, 14, 15, gluts, the upper two abaft the sail to hook bunt-jigger to when furling—the lower one forward of the sail for a midship buntline when reefing.

Fig. 341 a, represents a course.

PLATE 52

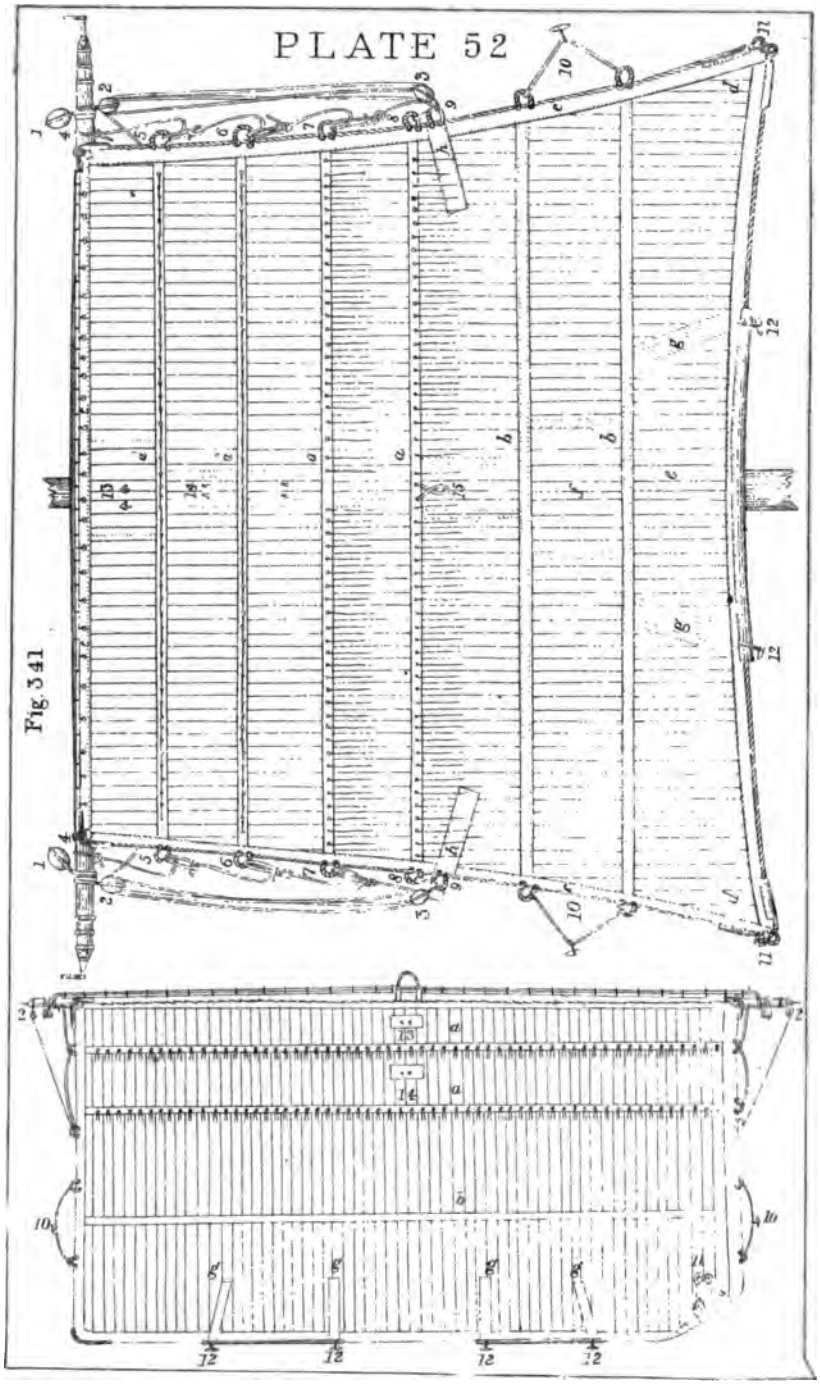


Fig 341

CHAPTER XI.

SAILS.

CANVAS is made of hemp, flax and cotton.

All canvas used in the navy for sails is flaxen, made in *cloths* of forty yards in length, and in breadth of twenty-four inches. These cloths are rolled up in separate packages, called *bolts*. The stoutest being No. 1, from which the canvas increases in fineness, and diminishes in strength, to No. 9 (see table at end of chapter).

There is much cotton used in the navy, but not for sails.

The flax plant, from which the flax is obtained, is a slender annual, growing from two to three feet high, bearing small lanceolate leaves. These terminate in delicate blue flowers. The filaments obtained from the fibrous covering of its hollow stems have been used, from the remotest times, in the manufacture of linen thread. Its seeds furnish linseed oil.

The plant is cultivated in almost all parts of the world. It is raised in considerable quantities in Ohio, Kentucky, Indiana, and other states, though that raised in Holland and Belgium is the most highly esteemed.

The fibre of the flax is obtained from the stalk by water and dew-rotting—the process, up to spinning the thread, being similar to that adopted for the hemp, already briefly described.

To obtain good canvas, for the making of sails, is of great importance. The warp and *shoot*, or weft yarn, ought to be made of long flax without any mixture of tow—of strong staple, fresh, sound and good of its kind. It should be well dressed, properly cleansed, evenly spun and well twisted, and all the weft-yarns should be fully as strong as the warp-yarn, and close struck.

In selecting canvas for sails, considerable practice and close observation are required. Besides the method detailed in the table of canvas, above-mentioned, a good test is to bore a fid through the canvas, when, if bad, the threads are easily broken.

It is of importance that canvas should have a good and even selvage, and be free from tightness.

SAILS.

There is a great deal of difference in the stretching of canvas—that which is badly struck together stretching most.

Twine. The cloths of a sail are sewed together with a double seam, and with the best flax sail-twine, of threefolds, spun from 360 to 430 fathoms to the pound. One pound of twine will sew four bolts of canvas, or 160 yards in length.

Bolt-rope, already spoken of under the head of ROPE, should be made of fine yarn, spun from the best Riga Rein hemp, and tarred in the best Stockholm tar.

To wear well it should be soft and pliable

Whatever may be the names or shape of sails, they all contain either three or four sides—that is, are either triangular or quadrilateral. The former of these, or three-sided, are sometimes spread by a yard, as lateen sails, or by a stay, as staysails, or by a mast, as shoulder-of-mutton sails; in all which cases the foremost leech (*or luff*) is attached to the yard, mast, or stay, throughout its whole length.

The latter, or those which are four-sided, are either extended by yards, as the principal sails of a ship, or by yards and booms, as the studding-sails, spankers, ringtails, and all those sails which are set occasionally; or by gaffs and booms, as the mainsails of sloops and brigantines.

The principal sails of a ship are—the courses, or sails on the lower yards; the topsails, which are next in order above the courses; and the top-gallant sails, which are extended above the topsails.

The courses are—the three square lower sails of a ship, and derive their names from the mast to which they respectively belong; as the fore, main and mizzen courses—that is, the foresail, mainsail, and cross-jack.*

In all quadrilateral sails, the upper edge is called the *head*; the sides are called the *leeches*; and the bottom, or lower edge, is termed the *foot*. If the head is parallel to the foot, the lower corners are denominated *clews*, and the upper corners *head-earings*.

In all triangular sails, and in those four-sided sails wherein the head is not parallel to the foot, the foremost corner at the foot is called the *tack*, and the after lower corner the *clew*; the forward corner of the head the *nock*, the after corner the *peak*, or head. The foremost edge (*or side*) is called the *fore-leech*, or *luff*, and the aftermost edge the *after-leech*.

* Cross-jacks are only met with in the merchant service.

SAILS.

The heads of most four-sided sails, and fore-leeches of lateen sails, are attached to their respective yards, or gaffs, by rope-yarns, called *stops* or *robans*, or by a *lacing;* and the upper extremities are made fast by *earings*.

The staysails are extended upon stays between the masts, whereon they are drawn up or down; and their lower parts are stretched out by a tack and sheet.

The royals are set above the top-gallant-sails, and skysails above the royals; and above them are sometimes sails called moonsails, sky-scrapers, and star-gazers.*

Studding-sails are set beyond the leeches of the foresail, top-sail, top-gallant-sail, and royal, their upper and lower edges being extended by yards, and booms run out beyond the extremities of the yards for this purpose. These sails are, however, only used in favorable winds and moderate weather.

Storm-sails are made of the strongest canvas, and are used, as the name indicates, only in the heaviest weather.

All sails derive their names from the mast, yard, or stay, upon which they are extended or attached. Thus the principal sail extended upon the mainmast is called the mainsail or main-course; the next above, which stands upon the main-topmast, is termed the main-topsail, etc.

In the same manner there are the foresail or fore-course, etc.; the spanker, mizzen-topsail, etc. Thus, also, there are the fore-spencer, and main-spencer; or, as they are sometimes called, the fore-trysail, and main-trysail, and spanker; the main-staysail, maintopmast-staysail, main-top-gallant-staysail, and a middle-staysail, which stands between the last two. All these staysails are between the main and fore masts.

Also, the mizzen-staysail, the mizzen-topmast staysail, the mizzen-top-gallant-staysail, and sometimes a mizzen-royal-staysail.

The sails forward of the foremast are the fore-staysail, the fore-topmast staysail, the jib, sometimes an outer jib, the flying jib, jib-of-jib, and, in small vessels, the jib topsail.

There are also the storm-sails, such as the storm mizzen and fore and main storm-staysails. The fore and main trysails are also used in bad weather, and frequently take the place of the storm-staysails.

These sails are generally used when "lying to."

* In the navy nothing is set above the royals. In the merchant service, rarely anything above a skysail.

SAILS.

The studding-sails being extended upon the different yards of the mainmast and foremast, are also named according to their stations, as the lower-studding-sail, the fore and main topmast, top-gallant, and royal-studding-sail.

The term *light sails* is generally understood in the service to apply to the top-gallant-sails, royals, flying-jibs, and studding-sails.

Jibs are of great command with any side wind, but especially when the ship is close hauled, or has the wind a-beam; and their effect in casting the ship, or turning her head to leeward, is very powerful, and of great utility.

Although the yards on the foremast are termed *head yards*, yet the fore-topmast-staysail and the jibs alone are known as the *head-sails*.

The *after sails*, which are those that belong to the mainmast and mizzenmast, keep the ship to the wind; on which account ships sailing on a wind require a head-sail and an after-sail—one to counteract the other, so that the spanker being at one end of the lever, as it were, and the jibs at the other, they are of great assistance in steering and working a ship.

When a ship sails with a side wind, the clews of the fore and main courses are fastened by a tack and sheet, the tack being to windward and the sheet to leeward. The tack is, however, only disused with the wind aft, whereas the sail is never spread without the assistance of one or both of the sheets.

When on a wind, ships are said to have their *starboard* (or port) *tacks aboard*, according to the side presented to the wind.

On the other hand, schooners have their *port* (or starboard) *sheets aft*.

When speaking of topsails, or such sails as are set by halliards, the altitude is termed *the hoist*, thus one topsail is said to have "more or less hoist" than another.

When speaking of courses the same idea is conveyed by the word *drop*, as one mainsail has "more or less drop than another."

It is under the topsails that many important evolutions are made, and they are justly accounted the principal sails in a ship.

The draft of the ship and spars, Fig. 277, Plate 35, is of great service to the sail-maker, as well as to the boatswain, for by it he can measure for and cut out a suit of sails.

SAILS.

The sailmaker generally makes his own draft to work by.

Were a sail to be exactly square, there would be little art in cutting, but as a ship's sails are, mostly, anything but square, there is much skill required in the arrangement of every cloth. In cutting out and making them up, it is a primary object to adapt and cut the numerous gores which, when brought together, will produce the ultimate form required, with the least possible waste of canvas; and this has been obtained by the long study and practical experience of the master-sail-makers, as the waste canvas in cutting out a large suit is trifling. This is effected by their method of casting the number of inches contained in each gore, so that when they are brought together they shall be equal to the number contained in the after leech-cloth. This is in reference to fore and aft sails, but the same theory applies in the parts of square sails.

Sails should *sit as nearly flat as possible.*

The boats of the Bermudians and Chinese are good illustrations. The former make their sails of No. 1 canvas, the latter of matting, stretched on bamboos, so as to present a flat surface to the wind; this enables them to have a very small angle of incidence, and also to trim their sails to a smaller angle with the keel than we are able to do, because, if our smallest angle of incidence is 30°, owing to the concavity of the surface, the lee leech will be nearly fore and aft when the yard is braced to 25°. But the Bermudians can trim their booms to 15°, and work within 8 points.

The Chinese boats are flat bottomed so that though they lie very close to the wind they are not weatherly.

The American schooner is another illustration, where, even the jib is frequently laced down to a yard or boom, fitted for the purpose, in the desire to have everything set flat.

In pilot boats and yachts the sails are set as taut and as flat as the sacking-bottom of a bed. The utility of this plan was exemplified in the race between the yacht "America" and the English yacht squadron. Going free, there was not much difference; but on hauling up to make a stretch to windward the flat canvas of the "America" enabled her to distance her competitors.

The efficiency of the "America's" sails, as well as those of all of our small craft, is due to their *goreless* shape, the canvas being cut as much as possible on the thread or woof, and also to the practice of lacing sails down taut to spars or booms. In Fig. 342, Plate 53, the foot of the sail is gored, and as it cannot be laced down, it bellies out to leeward, on a wind, and consequently much of the effect of the wind is lost.

In Fig. 343, Plate 53, on the contrary, the only gore is at the mast to which the sail is attached; each cloth is pulled downwards bodily, and every single thread is stretched. There is, with this sail, but little concave surface, and therefore but little of the effective pressure of the wind is lost. The same principle applies to all sails.

The perfection of equipping a ship with spars, rigging and sails, consists in so disposing them, that in a whole-sail breeze, the centre of effort of all the sails will be in the same line with the ship's centre of rotation, or that the efforts of the forward and after sails to turn the ship, will be so exactly balanced as not to require any continued assistance from the helm.

Cutting out Sails. Sails are cut out cloth by cloth, the width being governed by the length of the yard, gaff, boom, or stay; the depth by the height of the mast. The width and depth being given, find the number of cloths the width requires, allowing for seams, tabling on leeches, and slack cloth; and in depth, allow for tabling on the head and foot. Sails cut square on the head and foot, with gores only on the leeches, as some topsails are, the cloths on the head between the leeches are cut square to the depth; and the gores on the leeches are found by dividing the depth of the sail by the number of cloths gored, which gives the length of each gore. The gore is set down from a square with the opposite selvage, and the canvas, being cut diagonally, the longest-gored side of one cloth makes the shortest side of the next; consequently, the first gore being known, the rest are cut by it.

In the leeches of topsails cut hollow, the upper gores are longer than the lower ones; and in sails cut with a roach-leech, the lower gores are longer than the upper ones. This must be regulated by judgment, and care taken that the whole of the gores do not exceed the depth of the leech. By drawing on paper the gored side of the sail, and delineating the breadth of every cloth by a convenient scale of equal parts of an inch to a foot, the length of every gore may be found with precision.

The foot of square sails is *roached* so as not to be chafed by any boat, netting, or stay, that may stand in the line of their middle parts. When topsails are hollowed on their leeches, it is to avoid long yard-arms for the lower reef-earings; and in all sails, those cloths which are cut in any other direction than straight across with the thread or woof are said to be *gored*.

Sails gored with a sweep on the head or foot, or on both, have the depth of their gores marked on the selvage, from the square of the given depth on each cloth, and are cut as above; the longest selvage of one serving to measure the shortest selvage of the

PLATE 53

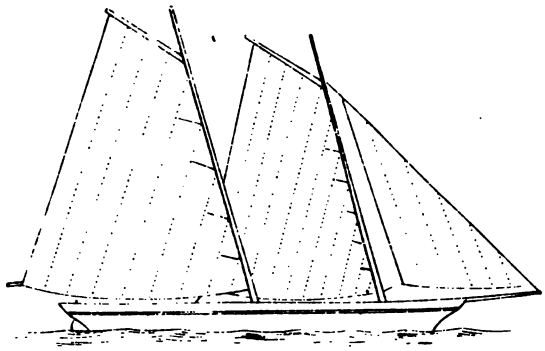


Fig. 342

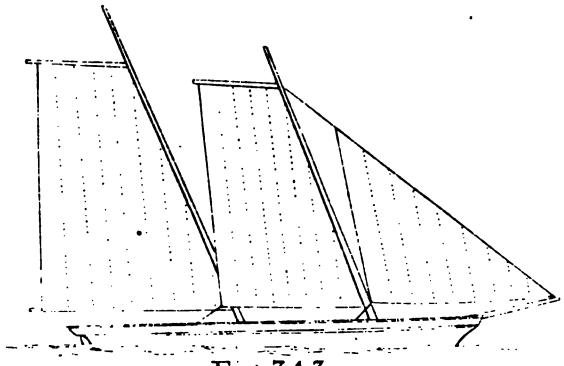


Fig. 343

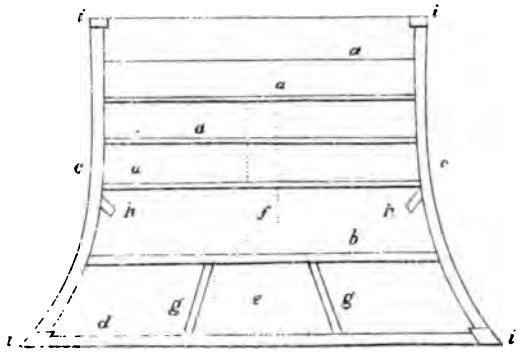


Fig. 344

next, beginning with the first gored cloth next the middle in some sails, and the first cloth next the mast-leech in others.

For those gores that are irregular, no strict rule can be given; they can only be determined by the judgment of the sailmaker, or by a drawing, and a scale of equal parts.

Although, in the given directions, the total amount of all sweep-gores is calculated at the rate of so many inches per cloth, each cloth has only such a gore as will form the sweep required.

The length of the reef and middle band is governed by the width of the sail at their respective places. The leech-linings, buntline-cloths, top-linings, mast cloths, and corner-pieces, are cut agreeably to the depth of the sail. Each cloth and every article should be properly marked with *red chalk*, to prevent confusion or mistake.

Sails are supplied ready-made, only requiring fitting with points, earings, bowline-bridles, beckets, and robands. Their edges are tabled and stitched to the bolt rope. The tabling of large sails is strengthened at the clews and foot by a third fold of canvas sewn in it. The tabling and clew patches are sewn on the after side of square, and on the port side of fore-and-aft sails.

Seams. Sails have a double flat seam, and should be sewed with the best American-made twine of three threads, spun three hundred and sixty fathoms to the pound, and have from one hundred and eight to one hundred and sixteen stitches in every yard in length. It is the erroneous practice of some sailmakers not to sew the seams any farther than where the edge is creased down for the tabling; but all sails should be sewed quite home to the end, and, when finished, should be well rubbed down with a rubber. The twine for large sails used in the navy is waxed by hand, with genuine beeswax, mixed with one-sixth part of clear turpentine; and for small sails, in a mixture made with beeswax, four pounds, hog's lard, five pounds, and clear turpentine, one pound. In some instances, the twine is dipped in tar, softened with a proper proportion of oil.

Boom-mainsails, and the sails of sloops and spankers of ships generally, have the seams broader at the foot than at the head.

The seams of courses, topsails, lower staysails, trysails, and spanker, are $1\frac{1}{2}$ inches wide, and stuck (treble seamed down the middle of the seam); those of other sails are 1 inch wide. One man can sew 100 yards in $9\frac{1}{2}$ hours, single seam.

Tablings. The tablings of sails are of a proportionate breadth to the size of the sail, and sewed at the edge with sixty-eight to seventy-two stitches in a yard.

SAILS.

Holes. Holes are made by an instrument called a pegging-awl, or a stabber, and are fenced round by stitching the edge to a small grommet, made with a log or other line. When finished, they should be well stretched or rounded-up by a pricker or a marling-spike.

Sails have two holes in each cloth at the heads and reefs of courses, top-sails, and other square sails; one hole in every yard in the luff of flying-jibs; and one in every three quarters of a yard in the luffs of other stay-sails.

Reef and head holes of large sails have grommets of twelve-thread line, worked round with eighteen or twenty-one stitches; small sails have grommets of nine-thread line, with sixteen or eighteen stitches, or as many as shall cover the line, and smaller holes in proportion.

In order to strengthen sails, it has been recommended to have the holes in the heads and reefs placed thus:—One hole to be made in the seam, another in the middle of the canvas, and so alternately; the holes in the seam to be half an inch lower than the hole in the middle of the canvas. By this, the strain would lie upon the holes in the seam, which are more capable of bearing it than the holes in the middle of the single canvas. It is likewise recommended to cut these holes with a hollow punch, instead of making them with a stabber or pricker.

Linings. Sails are strengthened with additional canvas at those places most exposed to strain and wear; in square ones, in the wake of cringles along the leeches on the foreside, called leech-lining, *c*, Figs. 344 and 345, Plates 53 and 54, in the wake of buntlines on the foreside, called buntline cloths, *g*; across the foreside, called reef and belly-bands, *a* and *b*; and in the case of topsails on the afterside, called the top-linings and mast-linings, *e* and *f*. Fore and aft sails are strengthened at the clews by tack-pieces; and jibs sometimes with a strain-band. There is also the foot-lining *d*, reef-tackle-patches *h*, and clew-patches *i*.

The clews of courses and topsails are formed of iron. The cringles for earings, reef-tackles, bowlines, &c., are formed of bolt-rope strands, worked round the leech-rope, through eyelet-holes in the tabling. The rope should be new, and half an inch smaller than the rope of the sail.

The reef-earing and reef-tackle cringles have composition thimbles.

Topsails have three bowline-cringles and two bridles on each leech.* Bowline-cringles have no thimbles.

* But one bridle according to present order, Fig. 341, Plate 52.

SAILS.

Generally speaking, topsails have three *gluts*, two abaft and one forward of the sail; the upper one is for the bunt-jigger to be used when furling sails. The second is for the same purpose when furling with a single reef, and the third, forward of the sail, is for a *midship buntline*, used for hauling up the slack of the sail in taking in the fourth reef.

Courses, Fig. 345, have two reef bands on the foreside, each being one sixth the depth of the sail in the middle from the head; with a belly-band halfway between the lower reef and the foot.

Topsails have four reef-bands, on the foreside, the lower of which is at half the depth of the sail; the belly-band, also on the foreside, is halfway between the lower reef and the foot. All top-gallant sails have two bowline-cringles.

Top-gallant sails generally have one reef-band, though not pointed, as it is rarely ever used. A topmast studding-sail has one reef-band for setting with single reefed topsails. A lower studding-sail has a *rolling-reef*.

Spankers have generally two reef-bands, one band running diagonally—termed a *balance-reef*.

Frequently the term balance-reef is applied to the close-reef in fore and aft sails, particularly on board of "fore-and-afters."

The jib has a reef-band, and frequently a *bonnet* which is attached to the foot of the sail by means of a lacing. The *lug-foresail* of a schooner has a bonnet also.

The term *lug-foresail* is applied to that of the schooner, when the foresail hauls aft by a sheet, to distinguish them from *boom-foresails* when the foot is laced down to a boom.

Roping. The bolt-rope sewed on the hollow or straight leeches of square sails, is put on with sufficiency of slack canvas to admit of that stretch of rope which arises from the action of the wind, or the constant strain or pull upon the margin of such sails; and the necessary allowance for the stretch of the whole is made in the calculation of dimensions of such sails. But in the leeches of fore and aft sails, as also in the round foot of spankers, jibs, &c., &c., a sufficient quantity of slack rope is introduced to keep the foot from curling up, to leave the after-leech of these sails free, and also to compensate for the amount of stretch which those parts of the sails above-named are constantly liable to.

Spankers are made with an allowance to stretch of $3\frac{1}{2}$ inches in each 3 feet of the foot, $1\frac{1}{2}$ in each 3 feet of the head, and $2\frac{1}{2}$ in each 3 feet of the length of the leech.

SAILS.

Sails are always bent to their yard or gaff with the roping next the spar, otherwise the stitches would be cut through by friction.

In square sails the rope is always sewn on the afterside; in fore and aft sails, generally on the port side. The roping of the foot is stoutest, tapering off to the leech-rope. See sizes of roping in partial table of Wabash's sails, at end of chapter.

Pointing. Courses are pointed by passing the end of the point from aft, through the eyelet-holes; a line is then rove through the eye of the points, the ends of which are secured at each side to the leech and the point hauled home. There are no after-legs.

They may be fitted by having the two ends forward and a jack-stay rove through the bights abaft the sail as before.

Topsails are pointed by reeving one long point through the eyelet-hole, and stitching it in so that two thirds will be abaft and one third forward of the sail.

Topmast and Lower Studding-sails are reefed by passing temporary stops of spun-yarn through eyelet-holes.

Boom-main-sails and spanker are pointed by stitching the middle part of the points in holes "stabbed" in the seams of the sails. As in reefing, there is only slack sail to be tied up, heavy pointing is unnecessary.

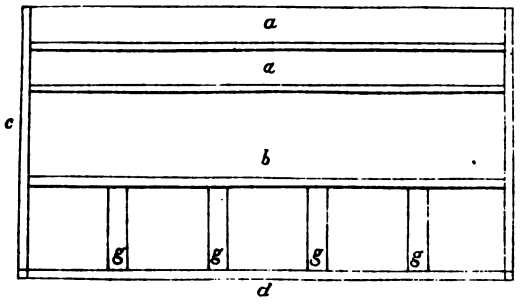
Reefing Beckets. Many sails have latterly been fitted with jack-stays in lieu of points, the points or beckets, being secured to the yard. The jack-stays on the sails are differently formed, Fig. 346, Plate 54. One way is to put both ends into the same hole from the fore side, knotting them on the after. Points jamb in these. Another way is to form the loop wider, by making it reach from hole to hole, knotting as before. This mode wrinkles the reef-band, and prevents it from being hauled out taut.

A third plan is to have a line fast from cringle to cringle across the after part of reef-bands, and to form the beckets on the fore side with another line, one end of which is made fast to the cringle; the other is rove through the first eyelet-hole, passed twice round the after line, out again, and so on across the fore part, and made fast to the opposite cringle, Fig. 346 (a). On the same principle, some put the bights of the foremost lines through the holes with a hard kink, reeving the after line through the kink. This is more quickly done, and nips harder.

A fifth plan is to weave the two lines different ways right across, in and out of the holes, stitching the crossings, Fig. 346

PLATE 54

Fig. 345



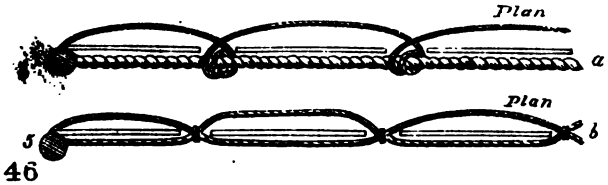
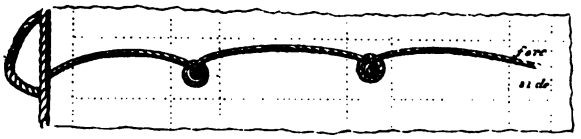


Fig. 346



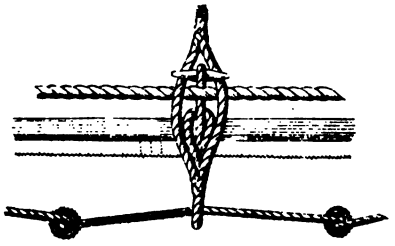


Fig. 347

Fig. 348

FITTING AND BENDING SAILS.

(b). Either of these last three answers well; a great objection to the first two is that there is nothing to lay hold of abaft the sail.

Fig. 347, Plate 54, shows the becket on the yard, and another plan of fitting the jack-stay on the sail.

The points are made split far enough down to admit of being toggled. They and the toggles are generally secured to the jack-stay; but if the jack-stay carried away, and the earings held on, the yard would most probably go on top in the slings. For this reason, it is best to make the points long enough to go around the yard, reeving through their own eye underneath and abaft the jack-stay, seizing the toggle, either to the yard or to the neck of the eye. See Figs. 176, 177, Plate 21. As the last-mentioned mode was found to be sufficiently strong and capable of being readily clapped on or shifted to a new yard, it has been thought by many to be the best. In some ships, two jack-stays are fitted on the topsail yards, with a view of keeping the reefs more distinct.

One great advantage of beckets is that the sails sheet home without fouling as do reef points.

A comparison of weights between reef points and beckets is greatly in favor of the latter.

FITTING AND BENDING SAILS.

Prior to bending, the sails should be carefully examined, in order to supply any omissions, such as the points, clews, cringles, bridles, thimbles, beckets, eyelets, toggles, and gluts. In addition to which, the fore and aft sails must be prepared with hanks, brail-blocks, lacings and lashings, and the square sails with earings and ropebands.

Earings (divided into two classes of reef and head-earings) should be spliced into eyelets, just below their respective cringles, with an eye sufficiently long to take one outer and one inner turn, which are consequently equal to two *single* outer and inner turns. The reeving-ends of the *reef*-earings (which are whipped), being made fast to the cringles of the next band (*above*), with a bowline knot; for example, that for the close reef to the third; the third to the second, and so on; the object of which is to place each earing within the reach of the men in reefing; a simple measure, but nevertheless of some magnitude in practice.

Or the reef-earings may be fitted thus: Those of the first and second reefs may be formed of two pieces of small rope; the

longest spliced into its own part, forming an eye two thirds the length of the earing; the other, spliced into each part of this eye, at equal distances apart, the bight of the two parts lying square with each other, Fig. 348, Plate 54. This tapers the earing, the end consisting of one part, the third quarter of two, the middle of three, and the part which forms the first turn of the earing, of four parts. All are marled together; and a seizing is put round the bights, making an eye to go over the yard-arm. These are commonly called the *bull-earings*, and are retained on the yard instead of in their cringles; that for the first reef being rove through its cringle and brought back to the yard ready for use.

The third and fourth reef-earings are formed of a single part, and are spliced into the eyelet-hole in the sail through which the lower turns of the cringle are passed, and seized to the cringle.

The ROPE-BANDS, consisting of two yarn-foxes, are middled, and secured to the head rope, by thrusting *one* end through the bight, which is first passed through the eyelet from the *fore* side of the sail, and hauled taut.

Gaskets. The next consideration is to place the *gaskets* on the yards. These are classed as bunt, yard-arm, and sea gaskets, and are usually made of plaited yarns. Those for the *bunt* consist of two single legs—one on each side of the slings, varying from two to three inches in width, and fitted with a thimble in one end, by which it is secured to the *bending* jack-stay with a permanent seizing—the other extremity having a laniard, which is hitched to the opposite quarter of the yard on top; the gaskets crossing each other on the bunt when the sail is furled. The *yard-arm* gaskets are made of sennit also, and fitted with a thimble, or eye, in one end, and the other tapering, and secured at equal distances (generally about every third seam), along the yard, *underneath* the jack-stay, by a cross-seizing just below the thimble. The gasket lies under the head of the sail. When furling it is taken up forward and over, and the end rove through the thimble, the sail tossed well up and the end expended around its own part.

In making harbor gaskets, the broad part should be long enough to take the sail in when furled with two reefs; they should be carefully blacked, and to avoid staining the sail, should be lined with duck.

The *sea-gaskets*, or more properly furling lines (of which there are two on each arm of the lower and topsail-yards), may be either of sennit or small-sized rope, and of sufficient length to go around booms and all, when furling in heavy weather. These, however, are not necessarily permanent fixtures to the yard, although usually put round it at the outer and inner quarters

with a running eye, and the surplus end bighted up with frapping turns, and thrown forward of the sail, at sea.

In order to illustrate more fully the minutiæ of bending sails, it is thought proper to bend each separately, and in the order of its size and importance, without regard to the usual routine.

BENDING COURSES.

Making-up for Bending. In making up a course for bending, stretch the head of the sail well taut along the deck or loft, having the *roping* on the *under side*, bring up to the head the belly-band, then the foot, leaving the clews out at each end, also the bowline-bridles, and roll taut up; pass the head-earing around the sail close inside the leech-rope, and put a stop of good spun-yarn to every seam. The reef-earings are made up in the sail.

By making the sail up in this manner the *head* and *foot* are both left out for bending the gear.

To Bend. Toggle the buntlines to the foot-rope at each side of the midship-seam, and clinch the leech-lines to their cringles, stopping both to the head of the sail—the former to the eyelet of the middle rope-band, and the latter in the wake of their leading-blocks. Hook the yard-arm jiggers (usually the clew-jiggers)* from straps around the pacific-iron to the first reef-cringles, hitching the head-earing to the standing part. Shackle or *seize*† on the clew-garnet blocks (with the ropes rove) to the after part, passing them *under* the sail.

Send hands on the lower yards, trice up the booms, man the gear and sway aloft, merely gathering up the slack of the clew-garnets. When high enough (i. e. when the centre of the sail reaches the centre of the yard), "bring to," cut the buntline and leech-line stops, and make fast the midship rope-band, together with three or four others at each side of it, by passing the short ends *under* the jack-stay from *forward aft*, and the long ones *over* and *under*, from *aft* forward—thence back through the eyelets, and square knot them on top. Haul the sail out until the

* Where the reef-tackles are rove, from the yard, through a block, toggled to a short bridle on the leech, below the last reef-band, the clew-jiggers may be dispensed with, and the sail hauled out to the yard-arms by the reef-tackles, which in this case should be rove on deck, and the head-earing-cringle stopped to the standing part. This plan, apart from the facility it affords in reefing, will be found serviceable in bending the sail.

† In lieu of having the shackles large enough to receive the clew-garnet block, with those for the tack and sheet, the former is sometimes *seized* to the clew as here stated, for the reason, that if the shackle should part or unkey, the sail may still be hauled up by the clew-garnet.

FITTING AND BENDING SAILS.

head-rope is taut along the yard, and pass two or three turns of the earing through the thimble of its strap, bring the cringle and thimble as nearly together as possible,* and pass the earing as follows, for a full due—viz.: *two* turns from out in, through the thimble and back to the cringle, expending the end leading last from the latter, *over* and *under* the yard, *inside* of the head-earing strap, and secure it by hitches around the turns *first* taken. Now make fast the remaining rope-bands in the same manner as the midship ones, and clinch or reeve the reef-pendants, as the case may be. Haul up the clew-garnets snugly, and shift the yard-arm jiggers to the forward futtock-plate, for the clew-blocks (through which the tacks and sheets are rove), and shackle them to the clews. Lastly, slack down and overhaul the gear, and set the sail to ascertain its fit, and if all is rove right, then clew up, hook the bunt-jigger, pass in the leeches, and furl.

If there is a *backer* on the yard, the head-earing will be taken through its eye instead of around the yard.

Fig. 349, Plate 55, represents the head-earing of a fore-sail hauled out to a staple on the yard, and a backer nailed with copper nails around the yard. It is very doubtful whether the staple is an improvement over the head-earing strap, which usually goes over the yard-arm. The sail, it will be observed, is bent to the iron jack-stay. The reefing jack-stay goes over the yard-arm; next to it comes a strap for the iron gin-block for the lower boom topping-lift; next, the strap of the brace-block; and, finally, the lift-block, with a becket for the standing part of the lift.

FURLING COURSES.

The Leeches are handed in along the yard, then the sail rolled up snug, with the ends of the points passed in towards the bunt, to give the sail a gradual increase in that direction. Pass the gaskets square, lower the booms, and if required, stop up the gear. The bowlines and leech-lines are stopped to the slings close down, and hauled taut on deck. The bowline-bridles of all sails in furling, are laid with the toggle towards the bunt, and bridles taut along the yard.

When a sail is neatly furled, it appears neither above nor below the yard—earings well slewed up—sail smooth under the gaskets, bunt square, and a *taut* skin. The heels of the booms should be square, and everything necessary completed, previous to *squaring* the yards.

* Riding down the head of the sail used to be recommended, but it is not approved of now.

PLATE 55

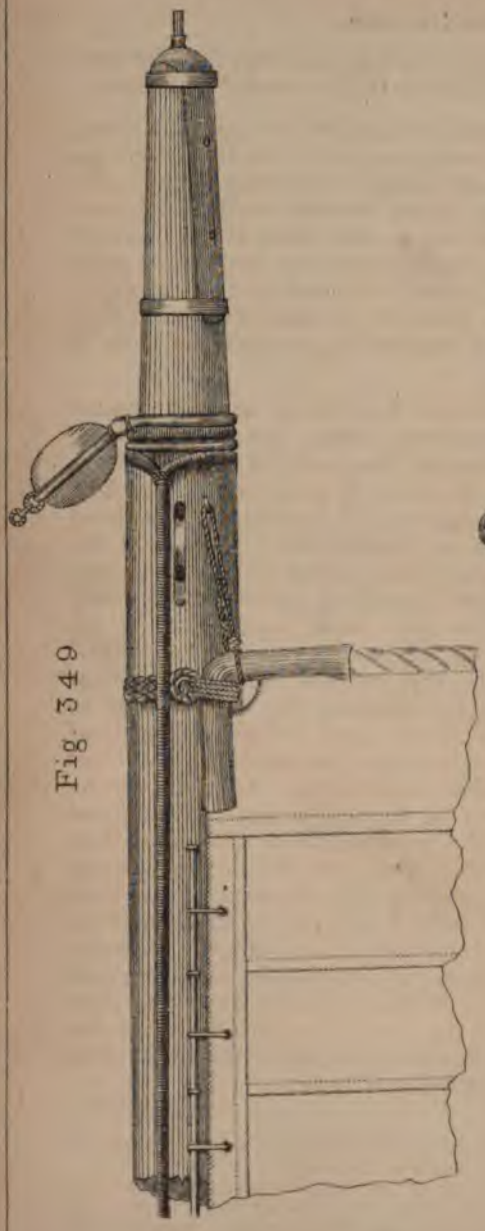


Fig. 349

Fig 350

BENDING TOPSAILS.

Having prepared the sails for bending, and supplied deficiencies, get them on deck and roll up on the *fore* part,* as follows:

To make up a topsail, stretch the head of the sail taut along, after side down; bring the second reef up to the head, and lay all the points and earings snugly along; then bring up the bell*y*-band, and then the foot. The clews, bowline-bridles, and reef-tackle cringles, should be left out, so that when the sail is sent aloft for bending, the sheets, reef-tackles, and bowlines, can be bent without loosing the sail, which will be found of great advantage when blowing fresh. Roll well up, stop with spun-yarn at each seam, and expend the head-earings round the ends of the sail.

To Bend. Hook the sail-tackle to a strap at the topmast head, stopped out to the topmast-stay collar, and to *one* bight of a stout pair of slings, passed around the centre of the sail. *Seize* the other bight to the *back* of the hook or to the strap, Fig. 350, Plate 55, and hook yard-arm-jiggers, for hauling out the head of the sail, if the reef-tackles are inadequate.† Overhaul the sheets and reef-tackles, bringing the bending ends of both into the top, and have the bowlines, buntlines, and clewlines ready for toggling, and bending to the sail. Send hands aloft on the yards, man the tackle, trice up the booms, and "sway aloft." When the sail rises above the top, cut the stops; shackle or clinch the sheets and reef-tackles, stopping the head cringle to the latter. Hook also the clewlines (or if double, *lash* on their blocks) to the clew-beckets, and toggle the buntlines and bowlines to the foot-rope and bridles respectively. Now haul out on the yard-arm-jiggers and lower on the sail-tackle until the head of the sail is stretched along the yard and its centre comes flush with the centre of the yard, then pass the middle rope-bands, rouse out the head-earings, cutting the seizings of the reef-tackles, and that of the slings around the sail; at the same time gathering up the slack of the buntlines and clewlines. Pass the earings, Fig. 349, and the remaining rope-bands, as in the case previously stated. Then unhook the sail-tackle from the stay, overhaul the gear, sheet **home** the clews, down booms, and hoist the sail up to a taut leech, **both** with and without the reefs; after which, lower the halliards, clew up, and furl.

* The reason for making the sail up on the fore part is to cause it to fall *forward*, and clear of the top, when cast loose from the slings.

† On board of the practice ships, in lieu of the reef-burtons and pendant which was the old plan, the sail is hauled out by the reef-tackles alone, the head cringle being stopped to the standing part, as in the case of the courses. And whenever reef-tackles are so rove, they may be used as yard-arm-jiggers.

BENDING HEAD SAILS.

It is better to toggle the buntlines before swaying the sail aloft.

When the sail is nearly rolled up, hook the bunt-jigger, bouse it well up, lower the buntlines and clew-jiggers, and *shove* the sail well into the skin, taking pains to keep the bunt square: pass and secure the gaskets, lower and square the studding-sail booms.

JIB.

This sail, as with those previously mentioned, requires certain equipments, not strictly within the contract of the sailmaker. Among these, we may note the lacing on of the *bonnet*, the *hanks* and the *brails*. The former, although confined chiefly to the naval service, and to small craft, as pilot-boats and sloops, (in which a staysail is not used), is secured to the jib by a lacing, as follows:

Keys are roped on the edge of the bonnets; these are rove through corresponding holes in the jib, working from both sides and knotting to a long key in the centre.

The Hanks which usually consist of stout thimbles sufficiently large to traverse freely up and down the stay, are attached to the luff by good-sized foxes of spun-yarn, rove through the eyelets, and passed around the hanks on *both* ends, which (being of sufficient length to fill the score) are knotted on the after side, and secured in frapping-turns, between the luff and hanks.

The Book of Allowances directs that all fore-and-aft sails running upon stays are to be bent with *bridles* of hide instead of iron hanks. The bridles are to be braided and toggled to the sails.

The Brails* (though previously described in the article on "Running-rigging") are simply middled and secured to the leech-eyelet with a cross-seizing; after which, they are rove forward through single blocks, fitted with a short span, and seized to an eyelet, or cringle on the luff for that purpose.

To bend the Jib, cast off and unreeve the stay from the boom (having a marrying-line bent to the becket in the end of the stay), and bring it in on the forecastle, or either side of the topmast-stays. Make the sail up in *bights* on the *foot*, in such a manner that the hanks shall stand one *above* the other, and reeve the stay *down* through them, and the down-haul *up*, hitching the latter to the head-cringle of the sail, and seizing both to the lower hank, just above the *nip*. Reeve the brails, and pass them (after the manner of a lashing) around the sail, and hook the halliards

* Obsolescent.

into the bights, swaying it up above the bulwarks. Re-bend the marrying-line (the hauling-end of which is also inboard), and man it, together with the down-haul, rousing out the jib, until the nip of the stay comes to the sheave in the boom. Then clap on the luffs, and set up the stay, for a full due; cast off the brails and hook the halliards to the head-cringle—reeving the former through their leading-blocks (between the guys) inboard to the forecastle. Seize on the sheet-pendants to the clew; man the halliards; cut the racking of the lower hanks and down-haul (passing the latter through its block, which must be seized to the nip), and hoist the sail up to a taut luff. Then lash the tack to the stay; trim aft the sheets; work the brails, to ascertain if all is rove right, and haul down and stow the sail.

When bridles are used, the jib may be sent out and bent without unreeving the stay.

To Stow the Jib. The jib is hauled close down, and the gaskets passed round it. The cover is then placed over, and the stops tied. Jib-sheets and halliards stopped down, and hauled taut.

The furling-line, or sea-gasket, is used when stowing a head-sail at sea; but for port there is fitted on the boom a *centiped*—a piece of sennit running the length of the boom, having, at certain intervals, short pieces of the same material running athwartship. The sail is stowed on the centiped, and the short ends are brought over and tied on top, thus answering for gaskets. Jibs require more care in stowing than any other fore-and-aft sail. They may be stowed in *their own cloths*, and made to look as neat as with a regular cover on.

Topmast-staysail. This sail is made up like the jib, viz., with the eyelets and the head, tack, and clew-cringles clear for bending; and is swayed out on the bowsprit by means of the down-haul and halliards—the latter being hooked to a stout strap, passed around the body of the sail, in lieu of brails (of which there are none). The hanks, which are either small wooden hoops, or horse-shoe-thimbles, having small eyes at each side of the opening, are secured to the eyelets by means of rope-yarn foxes, and are permanent fixtures on the stay.

The topmast-staysail stows in a netting, or canvas bottom, made for the purpose.

Flying-jib. The routine of bending, as stated in the case of the jib, answers for the flying-jib; it has neither brails nor bonnet; and in bending, the sail should be sent out on the *starboard* side of the bowsprit, on account of the inclination of the wythe (and consequently the boom) to that side.

BENDING FORE-AND-AFT SAILS.

NOTE. Much of the labor incident to the bending of the sail may be obviated by fitting it with a lacing in lieu of hanks—a plan which is preferable for neatness, and which saves the necessity of turning out the stay. This lacing is hitched to the upper eyelet, and rove in every alternate one to the tack-cringle, where it is secured—leaving between the eyelets a surplus bight, which (when it is required to bend the sail) is passed around the stay, *against the lay*, and seized to the eyelet omitted in reeving.

The plaited hide bridles are also "preferable for neatness," but for *utility* in working ship, the hanks (the head hank fitted with rollers) are far better than either.

Royals and Top-gallant Sails. In reference to these sails, little need be said (except that they should be always bent on deck, on account of the difficulty of hauling out by hand), as the earings and rope-bands are passed like those for the courses and topsails; the buntlines, bowlines, clewlines, and sheets, being bent after the yard is crossed. If, however, it should be necessary to bend the *top-gallant-sail* aloft, as is frequently the case on board of merchant ships, it may be sent up by the royal yard-rope, and the head-cringles hauled out by means of the top-gallant studding-sail halliards.

NOTE. In furling either a royal or top-gallant sail, it should be rolled up with a *long, taut bunt*, and the clews "tucked in," to avoid tearing the sail in its upward or downward passage.

These sails are *made up* with the clews out.

FORE-AND-AFT SAILS.

The manner of bending these sails is so nearly identical, that to avoid repetition, it is deemed proper to class the spanker and trysails under this head, and to bend them in the old-fashioned way—referring in the end to the different methods of equipment, and to the peculiarities of each.

In the making up, there appears to be no particular rule, except that each sail must be placed fore-and-aft, under its respective gaff (which should be lowered for the purpose), having the head and luff clear for bending. Reeve the brails in their blocks and sheaves, and pass the sail through the bights, rousing up and securing the *nock* (or throat) earing, which is usually passed around the gaff, and through the cringle. A neater and better way to secure the nock is, to attach the cringle to an iron staple, both ends of which are then shoved through holes made for them in the jaws of the gaff and key on top. This is very simple, neat, and secure.

BENDING FORE-AND-AFT SAILS.

Now haul the head of the sail taut along the gaff, and pass the peak-earing (consisting of small-sized ratlin stuff well stretched), which is taken (in *two* turns), from the cringle over the gaff, *abaft* a cleat on the upper side, and back to the cringle; expending the remaining part through the cringle, and around the gaff *inside* of the cleat; after which, take two half hitches around the outside turns underneath, to bind all parts together, and stop the end.

Seize on the brails to their eyelets on the leech (or, if the sail-maker should have omitted to work them, the point for those of the throat and peak may be obtained by bringing the leech in taut along the gaff, and marking the contact of the blocks and sheaves); then reeve them, and pass the head-lacing from *aft, forward*, through the eyelets, and around the gaff, taking a marling-hitch at each), on the upper side of the latter. Lastly, man the halliards, keeping the peak a little in advance of the throat, (in order to hoist easier), and seize the luff to the hoops (or hanks), on the trysail-mast,* as the sail goes up, by passing the rope-bands (which are middled in the eyelets) on both ends, and knot them in frapping-turns, between the luff and hanks. If the sail is a spanker, hook the out-haul block to the clew-cringle, and reeve the out-haul through its sheave. The tack is then either lashed to a bolt on the boom, close to the goose-neck or jaws, or fitted with a small gun-tackle purchase, hooked to the deck, and brought down taut along the trysail-mast.

In vessels where the spanker and trysails are fitted to traverse on a stationary gaff, as referred to under the head of trysail-masts, &c., they are usually sent up for bending by means of the in-and-out haulers, stopped to the throat and peak-earing cringles, and rove in their respective leading sheaves. The brails are, in this case, somewhat differently arranged, and in addition there is a clew-line and a peak down-haul, or in-haul. The head of the sail is secured to the hanks on the gaff, as in the case previously stated—the luff being seized to the batten, jack-stay, or hoops, with spun-yarn foxes.

Furling Spanker. It is also furled best with a cover; it can be furled in the two after cloths, the same as a jib, but it never looks so well, takes time, and in most instances has to be loosed two or three times before it gives satisfaction.

In furling with a cover, the sail is brailed close up, and the cover stopped round, commencing from the end of the gaff, and working in to the mast, and down on deck.

Trysails are stowed in the same manner as spankers.

* To the *travellers*, if fitted railway fashion.

BENDING LIGHT SAILS.

NOTE. Stowing fore-and-aft sails requires more handy work than seamanship, the principal object being to furl them in the smallest compass, and in the after cloths, as it brings the seams up and down. Square sails have often been admired from deck for their neatness, when the greater part of them were lying loose on top. This should be avoided as much as possible, as something should be sacrificed in appearance, to preserve a sail from injury. Taking a little trouble will get *all* the sail in the skin, and although it may be larger, it can be made to look quite as neat.

BOOM-MAINSAIL.

The routine, as stated in the preceding articles will be found to answer for this sail, there being, however, necessarily some slight exceptions, viz.: the omission of brails; and in lieu of an out-haul, the clew is shackled to a span on the boom. Another distinction, is, that the foot of the sail is stopped down taut to the boom by means of points or stops fitted for the purpose.

The old plan of tricing up the tack of a fore-and-aft sail has fallen into disuse.

STUDDING-SAILS.

The following method of bending these sails, will be found the neatest and best, by having the roping of the sail on the *after* and *under* side of the yard, and secured in such manner as to preclude the possibility of its "bagging down."

The outer earings, which are spliced into the cringles with a short eye, are passed through holes bored in the extremities of the yard, from the after side—thence back through the cringle and over the yard, *inside* of the hole, until three or four turns are taken, when the end is hitched through the cringle, and around the single part. The sail is then brought taut along the yard, the inner earing passed in the same manner, and the head-rope secured by a neat lacing of houseline, rove around the yard and through the eyelets with a marline-hitch on top, at each of the latter. Lastly the gear (the sheets and down-haul) is bent as described in "Running-rigging," and the sail made up, on the after side, by bighting the leeches towards the head, and running the gear along the yard.

To Make up Topmast Studding-Sails when not bent. Stretch the sail taut along, and overhaul the down-haul through the thimble and block, and bight it along the whole length of the leech. Then roll up towards the inner leech, lay the sheets along the whole length of the sail, roll up over all, and stop the sail well up with rope-yarn. The earings are expended round the

head of the sail. The top-gallant studding-sail is made up in the same manner.

When Bent. In making up a topmast studding-sail, when bent, overhaul the down-haul the length of the luff or outer leech; then take the foot up to the yard, and place the tack-block out. Bight the down-haul along the yard, also the sheets; roll the sail snugly up, and stop it with yarns.

Lower Studding-sails are bent and made up in the same manner as topmast studding-sails, with the sheet in.

When ready for sea, top-gallant studding-sails are kept in the tops with covers on.

The other studding-sails are rolled up in their covers and stowed on the booms.

It has been the practicé on board some of our ships, to keep, while at sea, the topmast studding-sail up and down the fore rigging, as the top-gallant studding-sail is in the topmast rigging; and the lower studding-sails triced up and down the foremast. This is a very good plan when circumstances render a frequent use of these sails liable, as they are by this means always at hand and ready for bending on the gear.

All spare sails should be *tallied*, before being stowed in the sail-room, as it will prevent mistakes; and if a sail is properly stowed, and the *sail-maker* takes a list when they are stowing, there can never be any difficulty in finding what may be wanted.

Sail-covers, for fore-and-aft sails, and for square-sails of steamers, very frequently have imitation gaskets, stitched or painted on the outside, which adds much to their appearance.

In addition to the cover for the mainsail and main-topsail some steamers have a "jacket" which laces around the mainmast, to protect it from the smoke of the funnel.

Back-Cloths. These are for stowing the bunt of the topsails in. They are made of stout canvas, roped around, and are attached to the after part of the yard close up to the topmast. When arranged for furling, one corner is stopped out to the foremost shroud of the topmast rigging, to the topsail-lift, or wherever convenient. They add very much to the neat appearance of the sail when furled.

They should be sent down when the sails are unbent.

An examination of this partial table of allowance of sails for first rates of the "Wabash" class, will give a good idea of the different numbers of canvas used and the various sizes of roping. All the sails allowed are not included in this table.

SAILS FOR A FIRST RATE.

SAILS.	No. of Sails.	No. of Canvas.	Size of Rope.			
			Head.	Foot.	Leech.	Hoist.
			in.	in.	in.	in.
Foresail	2	2*	2½	5¼	5¼	
Fore-Topsail	2	2*	2½	5¼	4	
Fore-Topgallant-sail	2	6	2	3¼	2¼	
Fore-Royal	2	8	1¼	2	2	
Mainsail	2	3	2½	4¾	4¾	
Main-Topsail	3	2*	2½	5½	4¼	
Main-Topgallaut-sail	2	5	2	3½	2½	
Main-Royal	2	8	1¼	2	2	
Mizzen-Topsail	2	3	2½	4¼	3¼	
Mizzen-Topgallant-sail	2	7	1½	2½	2	
Mizzen-Royal	2	8	1¼	2	2	
Lower Studdingsail	2	6	2¼	2¼	2¼	
Fore-Topmast-Studdingsail	2	6	1¾	2½	2½	
Fore-Topgallant-Studdingsail	2	7	1½	2	2	
Flying Jib	2	7		2¼	2¼	2¼
Standing Jib	2	4		3	3¼	3
Main-Trysail	1	2	2	3	3	3
Storm-Mizzen	1	2	2	2¾	2¾	2¾
Fore-Storm-Staysail	1	1		3¼	3¼	3¼
Main-Storm-Staysail	1	1		3½	3½	3¼
Fore-Topmast-Staysail	2	2		3¼	3¼	3¼

All sails are made of flax canvas; cotton canvas is used for the following purposes:
No. 1 is principally for the construction of Water-tanks for boats.
" 2 for Mess-cloths.
" 3 for making Tarpaulins and Head-cloths.
" 4 for Deck Awnings, Boom-covers, Hammock-cloths, &c.
" 5 and 6 for Wind-sails, Sail-covers and Boat-covers.
" 7 and 8 for Boat Awnings, Awning curtains, Wheel-covers, &c.
" 9 and 10 for Binnacle-covers, Side-screens, &c.
Hammock stuff for making Hammocks.
Bag stuff for Clothes-bags, Hatch-hoods, &c.
Cot stuff for Cots.

* One foresail, one fore and one main-topsail to be of No. 1 Canvas.

NOTE. All fore and aft sails, as well as courses, topsails and topgallant-sails, to be finished with iron clews.

A TABLE, showing the Length, Breadth, and Strength of Flax and Cotton Canvas, as used in the U. S. Navy. Together with the Number, Length, and Breadth of Strips cut crosswise and lengthwise, used in the Test of Strength, and the Average Weight required of them, before received for use.

NUMBER OF CANVAS.	Number of yards in Bolt.	Weight of Bolt.	Breadth of Canvas.	Distance of Blue thread from selvage.	Number of Strips cut for a test.	Breadth of Strips cut crosswise.	Length of Strips cut crosswise.	Breadth of Strips cut lengthwise.	Length of Strips cut lengthwise.	Average weight required to be borne by 3 Strips separately, cut crosswise.	Average weight required to be borne by 3 Strips separately, cut lengthwise.
	Yards.	lbs.	Inches.	Inches.	Number.	Inches.	Inches.	Inches.	Inches.	lbs.	lbs.
Flax Canvas, No. 1	80	105	24	1 5/8	6	1	24	1	24	470	300
" No. 2	80	100	24	1 1/2	6	1	24	1	24	420	280
" No. 3	80	95	24	1 1/2	6	1	24	1	24	370	250
" No. 4	80	90	24	1 1/2	6	1	24	1	24	340	230
" No. 5	80	80	24	1 1/2	6	1	24	1	24	320	216
" No. 6	80	70	24	1 1/2	6	1	24	1	24	300	200
" No. 7	80	60	24	1 3/8	6	1	24	1	24	280	193
" No. 8	80	52	24	1 3/8	6	1 1/4	24	1 1/4	24	300	213
" No. 9	80	52	20	1	6	1 1/4	24	1 1/4	24	290	200
Cotton Canvas, No. 1	80	90	22	1 1/2	6	1	22	1	24	280	250
" No. 2	80	85	22	1 1/2	6	1	22	1	24	260	230
" No. 3	80	80	22	1 1/2	6	1	22	1	24	240	210
" No. 4	80	75	22	1 1/4	6	1	22	1	24	230	200
" No. 5	80	70	22	1 1/4	6	1	22	1	24	220	190
" No. 6	80	65	22	1 1/4	6	1	22	1	24	210	180
" No. 7	80	60	22	1	6	1	22	1	24	190	170
" No. 8	80	55	22	1	6	1	22	1	24	180	160
" No. 9	80	50	22	3/4	6	1	22	1	24	170	150
" No. 10	80	45	22	3/4	6	1	22	1	24	160	140
Hammock Stuff	50	100	42	1 1/4	6	1	24	1	24	225	255
Bag Stuff	50	75	42	7/8	6	1	24	1	24	190	165
Cot Stuff	50	50	30	1 1/4	6	1	24	1	24	140	160

REFERENCES

FOR A

PLAN OF A FIRST CLASS SCREW STEAM SLOOP-OF-WAR

"CANANDAIGUA" AND CLASS.

BERTH DECK.		HOLD.
ROOMS, &C.	SCUTTLES, HATCHES, &C.	
No. 1. Captain's Cabin.	A. Scuttle to Paymaster's Store room.	No. 1. Engineer's Store room.
2. State rooms.	B. " Ward room.	2. Paymaster's "
3. Pantry.	C. " Magazine passage.	3. Captain's "
4. Water Closet.	D. " Engineer's Store room.	4. Ward room "
5. Store room.	E. " Captain's "	5. Magazine passage.
6. Companionway.	F. " Light rooms.	6. Magazine.
7. Ward room.	G. Hatch to Spirit room.	7. Paymaster's St. room.
8. 1st Lieuten't's State room.	H. " Paymaster's Store room	8. Spirit room.
9. 2d " "	I. " Engineer's "	9. Engineer's Store room.
10. 3d " "	J. Pumps.	10. Shell room.
11. 4th " "	K. Light to Shell room.	11. Hold.
12. Chief Engineer's "	L. Scuttles to Shell room.	12. Water tanks.
13. Master's "	M. Pumps.	13. Chain Lockers.
14. Paymaster's "	N. Hatch to Hold.	14. Shot Lockers.
15. Surgeon's "	O. Chain pipes.	15. Mast.
16. 1st As't Engineer's "	P. Cable bits.	16. Bread rooms.
17. 2d " "	Q. Flush Scuttles to Shot lockers,	17. Sail rooms.
18 As't Engineer's "	R. Foremast.	18. Ordnance stores.
19. Berths.	S. Scuttles to Chain lockers.	19. Marine stores
20. Mess Store rooms.	T. " Passage.	20. Master's stores.
21. Steerage.	U. " General Store room.	21. Hospital stores.
22. Armory.	V. Bowsprit bits.	22. General store room.
23. Carpenter's State room.		23. Passage.
24. Gunner's "	⊕ Dead flat.	
25. Boatswain "		
26. Sailmaker's "	4, 8, 12, 16, &c. Transverse sections aft.	
27. Dispensary.		
28. Paymaster's Issuing rooms	D. H. L. &c. Transverse sections forward.	
29. Mess Store rooms.		
30. Mizzen-mast.		
31. Main-mast.		

CHAPTER XII.

STOWAGE—THEORY OF STOWAGE—CONSTRUCTION AND PRACTICAL BUILDING.

Stowing a Hold and Spirit Room. The plan of the holds of a second-rate steamer, Fig. 351, Plate 56, shows their internal arrangements and method of stowage, but it is thought best to give the directions for stowing the hold of a sailing vessel, as they can be readily modified for a steamer and thus answer for both.

In performing this duty, an officer must be governed by the following considerations, viz.:

So to distribute the weights of ballast and tanks, which are permanent fixtures for the cruise, according to the form of the hold, that the vessel may be brought down in the water so as to preserve (as nearly as possible) her supposed best lines for sailing; which trim can be afterwards kept in the distribution of the provisions and other articles.

The proper stowage, and security of all articles.

Economy in space, and a general regard to the propriety of keeping near at hand certain articles for immediate use.

To avoid, as far as possible, taking any article into the hold until it has been properly cleaned.

The first thing to be attended to is, to prepare the hold for the reception of the ballast, by having it thoroughly cleansed and white-washed, and the limbers cleared; and then to stow the ballast.

Until within a few years, it was customary to nail *dunnage*, that is, strips of board or hoop-poles athwart the skin, on which to stow the ballast. The object of this was to allow a free passage for the water, and circulation of the air. This is now discontinued; the ballast is laid on the skin, affording more room, and excluding much dirt.

Pigs of iron are used as ballast in sailing vessels-of-war, which must be so placed as to promote an easy motion to the vessel. After weighing each piece, commence stowing them next to, and on each side of the kelson, on the skin of the vessel, extending forward and aft, from the greatest breadth of the beam towards

the bulk-heads, and an equal quantity and similarly placed on each side; the greatest spread in winging out being athwart the greatest breadth of beam: each succeeding row of pigs placed close to the last, and gradually diminished in length to correspond nearly to the form of the hold.

It being necessary to place a given quantity of ballast near the kelson and about her greatest capacity—which quantity will be according to the model of the vessel—you will be obliged in a *sharp-bottom*, to place several tiers, one above the other, each one winged out beyond the last in conformity to the dead-rise; while on a *flat-floor* the same quantity will be contained in the spread of the first tier.

In winging and lengthening out the ballast, be careful not to form an uneven stowage for the tanks or casks above them—and still place it so compactly that the weight shall bear equally in the body of the hold.

Winging the ballast tends to make a vessel roll, and building up amidships to keep her steady. Without venturing on details, it may be remarked, that the plan of keeping the ballast in the body of the ship, and clear of the extremities, seems to be most generally approved of; while at the same time care should be taken to keep her on, or parallel to *the line of flotation*, designated by the builder. The ballast in the spirit-room should be a continuation of that in the hold. Make a draft of the ballast, indicating the exact number of pigs, the position they occupy, and their exact weight.

After the ballast, are stowed the *water tanks*. The tanks are made to fit the form of the hold, and are put according to their marks, in their proper places. They are slung by placing an iron toggle, Fig. 209, Plate 24, in the *man-hole*. When stowed, they should form on top an even surface, and be placed compactly. They are then wedged with slips of wood,* and the

* If an iron bar be placed in an east and west direction from the centre of a compass-needle, and in a horizontal position, it will not disturb the compass, nor will the needle be affected by it; but a rod or wire so placed will conduct inductive magnetism to the compass. This is an important fact, because great magnetic energy may arise and influence a steering compass, from arrangement of the iron in a vessel. If, for example, a merchant vessel had a cargo of iron in her hold, or even iron tanks, steam-boilers, or cylinders, so stowed as to be in contact with an iron knee, or iron truss bolted to the ship's side, and running upwards to the upper deck beams, such a piece of iron being in contact with large masses of metal in the hold, would *conduct* or transfer the magnetism from below, and would certainly derange the magnetic needle, and cause the compass to indicate a wrong course.

It is on this principle of magnetic conduction, that separate pieces of iron when brought in actual contact, act magnetically as a single mass. The water tanks in a ship-of-war, *if stowed in actual contact*, will act on the compass, as if a single

seams caulked and pitched, that no dirt may work down between them.

The tanks are then filled with water, after which the riding tier of casks are stowed above them, placed on beds, and occupy the space between the forward part of the cable-tier and the after part of the fore-hatch; the breakage being forward by the fore-hatch.

Previous to getting in the tanks, a plan of stowing them may be easily arranged by means of rough models of them in wood. The tanks should be stowed and filled while the ship is being rigged.

Water casks, not only of the riding tier, but also those that form the ground tier in vessels without tanks, should occupy no more space than is absolutely necessary for their proper stowage; a few inches lost might probably prevent the stowage of a tier of provisions. Therefore, to economize in room, the beds should in all cases be made to fit the casks, and only high enough to allow their bilges to be free of the tanks or ballast.

Commence stowing the riding tier amidships at the break of the orlop deck, and stow forward to the after part of the fore-hatch, placing two beds under each cask. If the upper surface of the tanks is uneven, the breakage must be filled in with wood; chime-pieces are also placed between the heads, if the chimes do not match, otherwise they are unnecessary. Stow the next row by the side of this in the same manner, placing *hanging beds* between the casks to keep the bilges of each row free. The remaining rows are stowed as before; and when all are stowed, level off with wood, filling up all the breakages under and between the casks. All wood stowed in the hold, or spirit-room, should be previously barked, according to the old custom, but it is now deemed sufficient if each piece is beaten or struck together several times to knock off insects, dirt, or loose bark. Fire wood is much used for dunnage in chocking off casks and provisions in the stowage of the holds, and it is a fruitful source of dirt if such precautions are not adopted.

Next stow the provisions as compactly as possible, *pork* on the starboard side and *beef* on the port—and fill in with wood as before.

The space from the forward part of the main-hatch aft to the cable tiers is generally sufficient for the stowage of the *dry pro-*

tank of the same size as the aggregate number of small ones in the hold occupied their places. But if the tanks be kept separate by thin slices of board, then each separate tank, &c., will retain its natural quantity of inducting magnetism, and the place of its *poles* will change with the motion of the ship.—*W. Walker, Master R. N., on the Compass.*

visions; if not, the remainder may be disposed of in the wings over the *wet.* By dry provisions is understood flour, rice, beans, &c.

In the breakage at the fore-hold, are stowed all the *naval stores,* as tar, pitch, &c., the *gang-casks,* and all the movable lumber, such as *spare buoys, buckets, &c.*

Previous to stowing the provisions, battens should be nailed to the beams fore and aft, on which you may stow *plank, boards, oars, shooks, &c.,* placing those which will be most required in the battens over the orlop. Those in the fore-hold are reserved for the small pieces of *iron, spare rammers, sponges, gun-scrapers, ladles, &c.* Under the orlop are stowed spare *gun-carriages, trucks, lower caps,* and other articles that will not probably be required.

It is important to remember that all lime should be slaked before being received on board.

The *orlop* is that part of the deck where the cables are stowed, immediately forward, and on each side, of the mainmast. The cables being stowed, there is room enough forward of, and within them, to stow the *stream cable, hawsers, messenger, cat and fish hooks, pendant-tackles, nippers, &c.,* all of which should be so coiled that one or all of them may be passed up at a moment's notice. At anchor, it is usual to keep one cable-tier always clear, and in the other may be stowed all these spare articles as conveniently as possible.

If the vessel is without tanks, the casks forming the ground-tier should be made to fit the form of the hold, and stowed as directed for the riding tier, with floor and hanging beds, and chime-pieces. In all cases they should be stowed with their bungs up, and bilges free; commencing aft, and next to the kelson, and stowing forward.

The round-shot and chain-cables are stowed in their lockers under the main-hatch. The grape and canister shot, generally in the wings abreast of the main-hatch.

In the stowage of the spirit-room, the general directions given for the hold will be sufficient guidance. If any ballast is required there (as is sometimes the case), to preserve the vessel's trim, it is stowed first; then the spirit casks, above which are stowed, as completely as possible, all other articles, as sugar, tea, tobacco, slop-clothing, &c.

The medical stores are also stowed in the spirit-room.

A draft of the holds should be made, showing the tanks and their capacity, the casks, with the gauge marked on each, &c. See plan of holds, Fig. 352, Plate 57.

THEORY OF STOWAGE.

In order to understand the theory of stowage, and its importance, in the economy of the ship, it will be necessary to refer briefly to first principles.

The Stowage of a ship has reference to stability, speed, easiness of motion, economy of space, and convenience of access, and is, therefore, a subject of the greatest importance. In the distribution of the disposable weights, the first thing to be considered is the ballast. Its quantity, which is proportionate to the weight of guns, masts, and other top weights, is determined by the builder when designing the ship, whose form and size are so arranged that she will carry the proposed quantity without being too much immersed.

The purpose of ballast is to increase that quality in a ship called STABILITY, which enables her as much as possible to resist inclination, and to recover her upright position. And as it seems impossible to accomplish this without the existence of some weight which will counterbalance the disturbing forces of the wind and water and the top hamper of the armament, the supply of ballast is, in the first instance, stowed on the bottom of the ship. For, the weights above water are generally fixtures; whereas those below, such as water, provisions, fuel, &c., are necessarily diminished by consumption. If, therefore, there were no ballast, and the weights below water-level were removed or reduced, the equilibrum would be dangerously affected, and the ship could neither fight her guns, nor carry a sufficiency of sail to be weatherly or speedy. It is true that a partial remedy would be found in filling the tanks with salt water, but it must be well remembered that mere immersion does not give stability. With her crew sitting on the thwarts, or standing up, or seated on the bottom, a sailing boat will have the same immersion, but very different degrees of stability.

The WEIGHT OF BALLAST in modern times is much less than formerly, on the idea that the increased solidity of the several appliances required in a ship added much to her stability. Whether this were a correct supposition or not, other circumstances defeated the supposed advantage. Thus, Fincham observes: "In the year 1783, the larger class of three-decked ships had three hundred and forty tons of shingle, and one hundred and forty tons of iron ballast. In 1812 they had sixty tons of shingle and three hundred and forty tons of iron ballast; and when, some years later, iron tanks were supplied for the ground tier, the use of shingle was discontinued. At the present time, the ballast of three-decked ships varies from one hundred to two hundred and thirty tons.

THEORY OF STOWAGE.

"Fixed rules have been given at different times to determine what quantity of ballast should be used, and at present it is much less than it was formerly, as the greater dimensions which are now given to ships have increased their stability, whilst the solidity of the timbers of the frame, engine-boilers, chain-cables, iron-tanks, and other heavy weights, which are now put on board ships, increasing the weight below, and lowering the centre of gravity, have still further added to the stability. The advantages in point of stability which were thus gained, have been partially lost by the recent increase in the weight of the armament which is now borne by ships in the navy, an increase which is not wholly balanced by the greater quantity of shot and shell that is stowed in the hold."*

Thus, the experience of former times appears to be in favor of ships carrying large proportions of ballast. The days of St. Vincent supply instances of lengthened cruises made by ships in company in large numbers. The fleet of Nelson chased across the Atlantic twice, each ship holding her place. Whether these remarkable facts were the consequences of powerful stability resulting from ballast, or merely those of a very high order of seamanship, they are deserving of deep consideration.

As in general, stability will be increased by increasing the depth of the centre of gravity below the centre of buoyancy or displacement, it may be well to define these terms.

The CENTRE OF GRAVITY of any body is usually defined as that point upon which the body would balance itself in any position, when acted upon solely by the force of gravity. Its tendency is always to assume the lowest position that it can have compatibly with the conditions in which the body is placed; consequently, when it is in such lowest position, the body will be in stable equilibrium.

The same definition is applicable to the centre of gravity of any system or combination of bodies. Suppose a rod to have two equal weights, as at A and B, Fig. 352, Plate 57. The point C, upon which it would balance, is the common centre of gravity of those weights. But if any increase or diminution of weight were to take place on either side of C, the balance would be destroyed, and C would no longer be the centre of gravity; and to restore the balance, the prop must be moved towards that side where there was a preponderance of weight; from which it appears that the relation between the centre of gravity and the weights on either side of it, is the same as that between the ful-

* Fincham's Outlines.

crum of a lever, or the point of suspension of a balance, and the weights which keep it in equilibrium.

In scientific investigations, the centre of gravity of any body or system of bodies, is used to represent the body or system itself, all the mass and weight being considered as concentrated at that point, and all measurement which concerns their weight or its effects being referred to that point. Thus, reverting to the example above, the pressure weighing down upon the prop at C is equal to the sum of the two weights A and B, and in any calculation involving the joint effect of those weights, that pressure and the point C, at which it acts, would be substituted for the action of the individual weights.

A ship with all her weights in is, in fact, a system of bodies connected together, and composed of the hull, stores, &c., each article having its centre of gravity, and the whole combined having one common centre of gravity, upon which, when floating at rest, the ship may be said to balance herself.

But the water exerts a pressure upwards equal to the whole weight of the ship. Hence, in all questions affecting the flotation or the motions of a ship, we have to consider the effects of two antagonist forces, the weight of the ship and the pressure of the water, each of which must be treated as acting through its own centre of gravity; that of the former being called the centre of gravity of system, that of the latter, the centre of gravity of displacement, or immersion, or buoyancy.

A ship floating in the water, displaces a quantity of water equal in weight to the whole ship and her contents, and equal in bulk to that portion of her which is immersed. The result is that the water, in supporting the ship, presses upon all the part which is immersed with an upward pressure equal to her weight. As the surface of the part pressed upon is of an irregular shape, and as all fluids exert their pressure at right angles to the surface upon which they press, it follows that, in sustaining the ship, the water presses in an infinite variety of directions, the whole of which combined, may be represented by a vertical line, passing through the centre of gravity of a body of uniform density corresponding in shape and dimensions to the immersed part of the hull of the ship. This line is called the resultant of the pressure of the water, and the centre of gravity through which it passes, the centre of gravity of displacement.

When the ship is upright and floating at rest, these two centres are in the same vertical line, the ship herself, by the action of her own weight, adapting her trim so as to bring them into that position. But in a seaway, this state of things is disturbed.

THEORY OF STOWAGE.

The accumulation of water in the form of a wave, changes the direction of the different pressures on the hull, and with them the resultant of the pressure; and the motion of the ship which follows, is simply a series of efforts on her part to recover her state of equilibrium or balance. For instance, a sea pressing on the bow draws the resultant of the pressure farther forward than the centre of gravity of system. That point being no longer adequately supported, sinks until a sufficient pressure on her after body has been regained to bring the resultant back into its old position. As the body of the sea, carrying its resultant with it, passes under the centre of gravity of system, the ship is balanced for a moment at her ordinary trim; and as it passes aft, the balance is again disturbed, and the bows sink until it is again restored. The rolling motion is produced by the same process.

From what has been said on the relative position of the centres of gravity and displacement, it will appear, that if it be desirable that a ship should float at a certain trim, it will be requisite to arrange the weights in her so as to insure their common centre of gravity being in a certain position. This arrangement is accomplished when the sum of the moments of the weight before the point determined on as the centre of gravity is equal to the sum of the moments abaft it,* because the effect of any weight in influencing the position of the centre of gravity is in exact proportion to its distance from it; a small weight at a great distance producing the same effect as twice the weight at half the distance.

If the trim of the ship were the only consideration, this arrangement would be simple enough, but the effects of the weights on pitching and rolling motion must also be considered.

It is a law in mechanics that, while the effect of a weight in merely depressing or balancing the arm of a lever, is as its distance from the fulcrum or axis, the momentum or power of the weight in motion (as when a ship is pitching or sending) is as the square of that distance. Thus, suppose two guns each weighing five tons, placed the one at forty and the other at fifty feet from the centre of gravity. The moments of these guns, when the ship is at rest, will be as $5 \times 40 = 200$ to $5 \times 50 = 250$, their difference being 50; whereas their momenta will be as $5 \times 40^2 = 8{,}000$ to $5 \times 50^2 = 12{,}500$, the difference being 4,500. These figures will give some idea of the extent to which heavy weights placed at the extremities of a ship may aggravate her pitching in a sea-

* The term "moment" meaning the product of any weight multiplied into its *distance from* the centre of gravity.

way, and show the wisdom of concentrating them as much as may be convenient.

There are many disposable weights, in the distribution of which we may develop, or fail to develop, or even defeat, the design of the builder; for although a ship when at rest may be apparently in the best sailing trim, it does not follow that she is so in reality. A certain line of flotation might be produced by stowing one half of the disposable weights in the fore end, and one half in the other: or the whole might be stowed in the centre. In either case the ship might, according to the copper marks, be correct as to a stipulated measure of draught, but the instant she entered uneven water the difference in the modes of stowage would be manifest. In the former case she would plunge heavily, strain her fastenings, and break her cordage or machinery, and stop her way; in the latter, all would be the reverse. For a ship, when at rest, is not equally water-borne at *all points*. The fuller midship sections are pressed upward, while the finer extremities are sustained, partly by the water and partly by their connection with the central body. . There is, consequently, such a constant tendency in the foremost and after ends to droop, that when ships are cleared of their material, it is found necessary to load them with ballast, until all parts derive support from the water, and thus to correct as much as possible the natural inclination to "hogging."

It can easily be understood that, by stowing weights at the extremities, not only is the "hogging" tendency encouraged, but (when, as in a sea-way, the water has altogether receded from under the forebody and the wave has passed the centre) the ship will plunge heavily until the bow meets with a material resistance. In this way, the best of ships unfairly acquire an unenviable reputation for pitching.

Foreseeing these possibilities, we find one architect saying, "A ship badly constructed, whose faults are to be corrected by stowage, will sail badly; and that which is well constructed, if badly stowed, will do no better: the stowage, therefore, is an essential, difficult, and delicate part of a ship's economy, to perfect which the officers do very properly to act in concert with each other."* And another, "A ship of the best form will not show her good qualities except it is at the same time well rigged, well stowed, and well worked, by those who command it."†

"If," writes a third, "we were to rely confidently upon all that has been said of the great effects on the sailing of ships, resulting from the moving of small weights, we should hardly know

* Du Hamel. † Chapman.

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how to limit the importance of stowage; but while the extent to which small changes are said to affect the sailing of ships, may seem questionable, the fact is established beyond all dispute, that along with alterations in the trim of most ships their sailing qualities are altered. Experience has shown that the magnitude of such effects depends greatly on the form, some ships being more easily put out of trim than others. The investigation of the subject requires yet to be pursued by practical means, for hitherto much is uncertain."* There appears to be more ground for the belief in the effect of small changes on the sailing of ships than this eminent architect seems prepared to admit.

And this brings us to the problem of stability, or the resistance of a ship to the pressure of her canvas, which is capable of the same explanation as the pitching and rolling motions.

The pressure of the sails, acting at their centre of effort on the masts, heels the ship over, and, in doing so, virtually alters the shape of her immersed portion; by which alteration the resultant of the pressure of the water and the position of the centre of gravity of displacement are also changed. The centre of gravity of system remaining fixed, the resistance to the heeling power is the effort of the ship to recover her equilibrium, and to bring the two centres of gravity back into the same vertical line.

Fig. 353, A B C, Plate 57, represents a ship heeling under canvas: her centre of gravity of system being at G: A B the water-line, and D her centre of gravity of displacement when upright: *a b* her water-line, and *d* her centre of gravity of displacement when heeled over; its position, having undergone a change consequent on the change of form from A B C to *a b* C, produced by the inclination *d* E, is now the resultant of the pressure of the water. The action of the different forces may be thus briefly explained. As the ship, on heeling turns round an axis passing through her centre of gravity, G S may be considered as a lever, S the centre of effort of the sails pressing in the direction S T to heel the ship, *d* the displacement (equal to the whole weight of the ship) pressing upwards in the direction of the resultant *d* E to right her.

Draw G H at right angles to *d* E. By a principle of the lever, the power exerted by any force, acting obliquely on a lever, is proportionate to the distance from the fulcrum at which it acts, that distance being measured on a line perpendicular to its line of action. In the case before us, therefore, the displacement or weight of the ship multiplied into G H constitutes the force exerted to right her.

* Fincham's Outlines.

PLATE 57

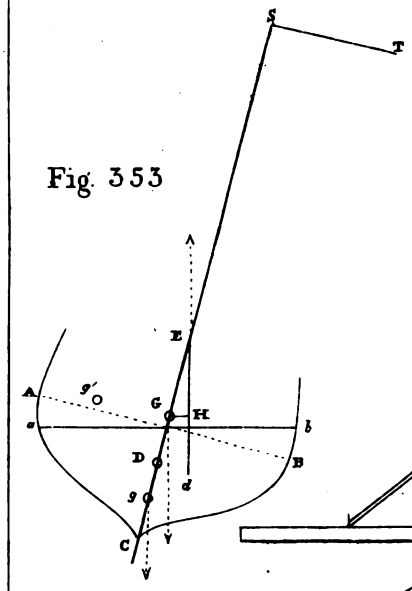


Fig. 353

Fig. 352

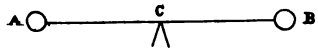
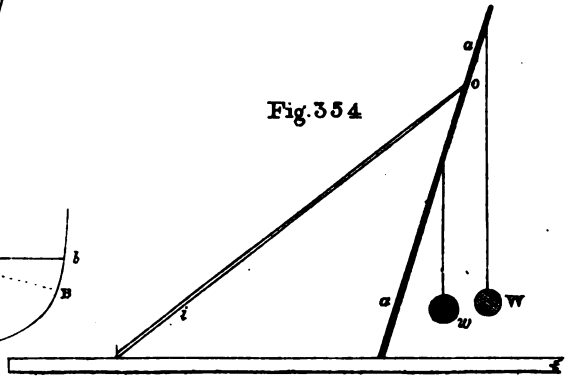


Fig. 354



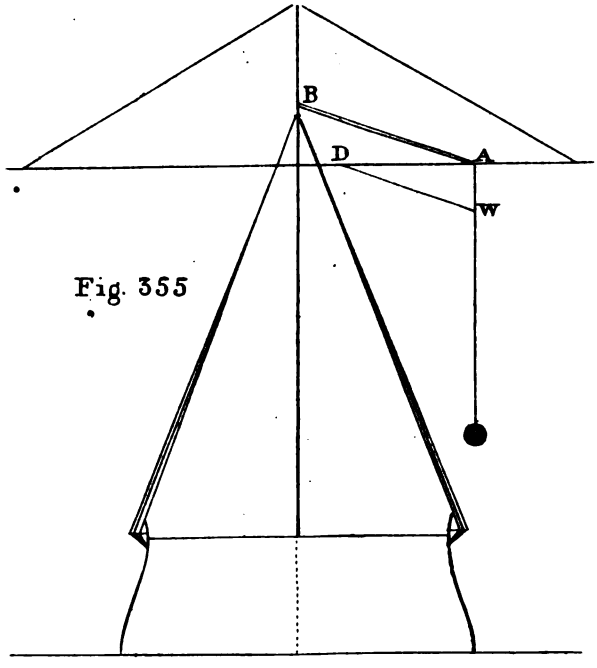


Fig. 355

This Scale applies to Figs. 355, 56, 57, 58, 59, 60.

10 20 30 40 50 60 70

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From this it appears that the longer the line G H can be made at a given angle of inclination, the greater will be the stability of the ship. This may be done in two ways, 1st, by lowering the centre of gravity of system, which is effected either by adding to the quantity of ballast, or by lowering some of the weights already existing in the ship; 2d, by drawing the centre over to windward, by means of shifting the ballast.

The point *g* illustrates the first method, *g'* the second. In either case a perpendicular drawn to the line *d* E from these points would be longer than G H.*

Both these methods of increasing stability are practicable, and are constantly resorted to in boats. The first, by filling the breakers, and making the men sit down in the bottom of the boat; the second, by making the men sit up to windward. Of the two, the former is unquestionably the safer, as the increase of stability is permanent on either tack; whereas, when the latter method is adopted, if the boat should be suddenly taken aback, before there is time for the men to regain their proper seats, all the gain of stability on the one tack is exactly so much loss of stability on the other; and an upset must be the consequence. This catastrophe has been known to happen in passing under the stern of a ship, in a strong breeze, from the eddy wind taking the sails in reverse.

The most certain mode of preserving trim, is by use of the Water Level. A leaden pipe bent upwards at both ends is let into the lower deck beams under the planking, in a fore and aft line, as nearly amidships as the hatchways will permit, the ends are terminated with glass tubes, which are graduated, and for greater security brought up alongside some convenient stanchion. On the tube being filled, the water rises to its level at each end, and the ship's best trim marked off when she is perfectly still.

Any subsequent alterations in the trim, either from expenditure of stores, or variations of wind, are immediately denoted by the levels, and may be at once rectified by the movement of disposable weights, such as shot, any number of men, &c., so that at sea, when it would be impossible to discover the trim by the copper marks, it may be thus ascertained without difficulty; and the effects of alterations in the force of the wind, otherwise im-

* The point E, at which a vertical line, drawn from the true centre of gravity of displacement, cuts another that has been drawn from the former one, is called the *meld centre*. By studying the direction of the different forces, as indicated by the arrows, it will be obvious that unless this point be above the centre of gravity, the vessel would upset.

perceptible, are declared by the amount of pressure by the head, indicated by the level.*

This instrument will appear the more valuable when it is remembered that, on carrying a press of sail, a ship always settles considerably by the head; and that unless this tendency be corrected by moving weights from the fore-body (supposing the sails to be well trimmed) the increased resistance will neutralize the propelling force. For although, as a general rule, the gain by carrying a press of sail is little as compared with the risk, yet there are times when that little might be of much consequence; and we should be prepared, not only with good gear to press on with, but with a good instrument to inform us that speed is undiminished, if not increased.

Few things are more fallacious than the appearance of speed which a vessel's movement presents. Judging from the quantity of water dashed from her bows, and the noise made by her passage through the waves, one would infer a high rate of progress. But it is found that all this time the ship's bows are unduly depressed, and that the commotion of the water, supposed to be evidence of speed, is, in fact, only evidence to more water being displaced than is necessary. Thus, in a first class frigate, the depression has occasionally amounted to eighteen inches; the remedy adopted being, not that of reducing sail at the expense of propelling power, but of adjusting trim, and that by the help of the instrument described.

In treating on the subject of fluid resistance, Dr. Arnot observes: "A boat which moves one mile an hour displaces a certain quantity of water, and with a certain velocity; if it move twice as fast, it of course displaces twice as much water, and requires to be moved by twice the force on that account; but it also displaces every particle with a double velocity, and requires another doubling of the power on this account: the power being then doubled on two accounts, becomes a power of four. In the same manner with a speed of three, three times as many particles are moved, and each particle with three times the velocity; therefore, a force of nine is wanted to produce it; and so for a speed of four, a power of sixteen is wanted; and for a speed of five, a power of twenty-five. The corresponding numbers, up to a speed of ten, are shown in the following table:—

Speed	1	2	3	4	5	6	7	8	9	10
Corresponding resistance	1	4	9	16	25	36	49	64	81	100

* In the absence of a better, a temporary level may be constructed with a length of *good hose*.

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So that the force of one hundred horses would only drag a boat ten times as fast as the force of one horse. Arithmeticians express the relation shown in this table, by saying that *the power required to move a body in a fluid increases as the square of the speed.*"

"If an engine of forty-nine or fifty horse power would drive a boat seven miles an hour, two engines of fifty, or one of one hundred, would be required to drive it ten miles, and three such would only drive it twelve miles. For the same reason, if all the coal which a ship could conveniently carry were just sufficient to drive her one thousand miles, at the rate of twelve miles per hour, it would drive her three thousand at the rate of seven miles per hour; and nearly six thousand at the rate of five miles per hour."

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* If we analyze the guiding rules of naval architecture, we shall find that the salient points in the character of every well-built ship are these:—

First—SAFETY, which involves the consideration of *strength.*

Second—CAPACITY, or the adaptation of space, embracing as it does the law of proportions, and the whole question of dimensions.

Third and lastly—SPEED, which is dependent upon form and shape.

The perfection and beauty of American models have always challenged the admiration of the civilized world; but, in order to appreciate their merits, we should look into the elementary principles upon which they are designed. I have set out upon the general idea that every good ship must necessarily involve three conditions, the first of which was safety.

To attain *safety*, it is necessary to have *buoyancy*, and to have buoyancy the vessel must have length. Experiment has demonstrated that for sailing craft this should only vary between *four* and *five* times the breadth of *beam;* for if we exceed the maximum limit, we sacrifice *strength* (which is one of the material elements of safety), and render the lateral movements of the vessel tardy, on account of the length of the arc she describes in the performance of the evolutions of tacking and wearing. If, on the contrary, we diminish the length below the minimum (still preserving the breadth), we again lessen the power of speed, by rendering the vessel bluff and clumsy, whether we regard her

* Lecture on American ships and ship-builders, by John McLeod Murphy.

of rectangular or circular form; for it must be borne in mind that when we combine length and breadth, we have necessarily then to consider shape, upon the relative proportions of which as we shall see, depend almost entirely the safety, capacity and speed of our future ship.

To have *capacity*, the vessel must have *depth*, for otherwise she would be only a surface; and here again experiment has prescribed the limits which guide and govern its application, viz.: that it should never be less than *one half* the breadth of beam, nor more than two thirds; because, in the first case, we would destroy *buoyancy* and *capacity* by an excess of shallowness, causing the vessel to be stiff and laborsome. To counteract this inconvenience, strength is absolutely essential; and yet strength is an utter impossibility under these circumstances of length and breadth. In the other case, on the contrary, the centre of gravity is so much elevated above the line of flotation, that the vessel becomes altogether too unstable to answer the conditions of safety. Hence we perceive the force and deduction of this rule—a rule which becomes infinitely simple, so far as the matter of *dimensions* is concerned when we have once established the beam of our embryo ship.

Not the least important consideration is *speed*, and it is by the full development of this quality that American ships have chiefly won their celebrity among the fleets of the world. Speed can be attained by constructing the bow, bottom and after-body in such a manner as to cleave the water with the least effort, and at the same time assist its afterward transit. In shaping the stem, from the top-rail to the light-line, it is usual to give it a slight rake of not more than one foot to every three feet of depth, so as to render the vessel buoyant forward, and lift her in plunging, which would only be the case after a portion of the sea had boarded her, if the stem were made to rake any considerable quantity. But below this it should be rounded off, because a ship with a straight stem will invariably sheer when she careens, and conversely, careen when she sheers. Besides this, a straight stem would compel an unnecessary degree of sharpness in the lower lines. The bow should be made sufficiently sharp to *cut*, *not bruise* the water, and the more wedge-like we form it, consistent with strength, the nearer the aftward course of the water will approach to a horizontal line, and the smaller will be its angle of resistance.

The great difficulties to be avoided in modelling a vessel, are friction and what is called the "pneumatic resistance." When a body moves through water, the pressure on its sides constitutes friction, and forms a part of the resistance to be overcome. The

form of all others best calculated to obviate it is that of a *globe*, because there is less surface exposed in proportion to the solid contents of the vessel. If we elongate it as we do in making a model, to attain a higher rate of speed, we diminish the resistance proper to the mass, but multiply the friction in the ratio of elongation. Hence, in all cases, the model and the means of the propulsion should be made to correspond. In calculating the power required to move bodies on a railway, we consider the friction as a fixed quantity, and then allow for adventitious causes of resistance, as the opposition of the wind, concussion from vibration, &c., which vary with the speed or other causes. It is precisely the same case with a ship. The constant resistance is friction. First, the friction between the water and the sides and the bottom of the vessel; and second, the friction between the particles of water itself displaced by the bow, and closing in behind the midship section as the vessel proceeds. Resistance from this friction proper is the same at all velocities; but there are other forces to be overcome, which vary *with* the velocity, and these are principally gravity and the pneumatic resistance, both of which are distinct from the unavoidable and necessary resistance of a body passing through water, and which is said to increase in a four-fold ratio with every increase of speed.

At the midship section,* or point of greatest breadth, the floor should have a "dead rise" of about 8°, or, since a vessel seldom heels more in the ordinary circumstances of sailing, an inclination upward equal to the angle her deck would form with the horizon in careening under a pressure of sail. The object of this is, that, when the vessel lies over thus, she rests upon a flat floor, against which the water, acting vertically, exerts its greatest upward pressure to right her; while at the same time it operates upon the keel, and prevents the vessel from sliding to leeward. If, on the contrary, the vessel is constructed with a flat bottom or floor, she will be less stable than one in which the dead rise is greater, and in careening, all that portion of water contained between the bilge and the lower part of the keel will, in consequence of the deeper immersion of the former, be filled with eddies, which exert no pressure whatever to prevent the vessel from making leeway.

* The position of the midship section or *dead flat*, as it is termed, is still a mooted point. The old rule placed it one third of the length from the stem, but it has gradually worked aft till now some of our best models have it *abaft* the centre.

The dead-rise is sometimes estimated by a lineal measurement being the perpendicular, included between the outer extremity of the half-floor at the dead-flat, and a horizontal line drawn from the base line. Hence, a vessel is said to have six, eight, ten, &c., inches dead-rise.

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The *length* of the floor depends less upon fixed principles of construction than the attention which is paid to the consideration of *sharpness;* and it is plain that the longer the ship, the longer the floor.

An important feature in construction is the shape of the sides above the water-line, inasmuch as it embraces, to a certain extent, the consideration of strength and stability. If the vessel be "wall-sided," it is evident that, in careening under her canvas or otherwise, all the weight on the lee side above the proper bearings will project beyond the base of the floor, while, at the same time, the *outward* pressure of the cargo in this portion must be sustained by the top frame. In vessels-of-war, which carry heavy weights on the spar-deck, this feature becomes of paramount importance. If we reverse the principle, and make the sides to "tumble home," or to "swell," the weight of the cargo will seldom extend beyond the bearings of the ship, and the downward tendency will be communicated through the frame timbers to those of the floor, against which, as we have seen, the reactive pressure of the water is at right angles to the gravitating force. As a general rule, the tumbling home should not exceed an inch to the foot of depth of hold.

In reference to the shape of the after-body, care must be taken that the *counter* be sufficiently high, and the *run* clear, to diminish as much as possible the pneumatic resistance. Indeed, unless the after-body be clean and sharp, the course of the water in its escape from the bottom is *flattened* and full of eddies, a result which is highly detrimental to the steerage of the ship; first, by precluding the access of the water to the rudder, and second, by bringing the entire strain on the heel. In a ship with a well-proportioned after-body, the course of the passing currents is less horizontal, and the point of resistance on the rudder, in lieu of being at the heel, is more *central;* hence we see the necessity of having the broadest parts near the middle, and the reason why the heel is rounded off.

What has been said thus far refers solely to *sailing* vessels.

In the modelling of *steamers,* there are material differences. As a general rule, the American ship-builder makes his model precisely *as if the vessel were always to sail with a fair wind.* The ends are sharpened as nearly as possible alike, with reference to *buoyancy,* but not to *form,* the object being to get the midship section or dead flat *amidships.*

In the brief view of the rules I have enunciated for sailing craft, we have seen that length is essential to sharpness, and sharpness to speed; and since speed is more important than

capacity for cargo in a steamer, the sacrifice of the latter is made in order to overcome the increase of resistance which arises from the increase of the propelling power. Hence the length of steam-vessels is extended to *six* and even *eight* times the breadth of beam. Again, too, the *floor*, instead of being formed with a dead-rise (as in the case of a sailing-vessel), is almost entirely *flat*. A horizontal floor is found to be more advantageous for attainment of speed than any other shape, by giving the vessel a greater amount of buoyancy, while it obviates, in some measure, the sacrifice of strength and capacity which result from the increase of length.

Ordinarily, in adjusting the boilers and engines of a side-wheel steamer, they should be placed so as to put the centre of their weight in the centre of the vessel's buoyancy. For convenience and comfort, the boilers are generally put forward of the midship section; hence, in that case, the wheels are brought abaft it, but whether they be placed on either side of it, no noticeable difference in speed has been observed. The advantage in locating the wheels forward is that they strike a denser volume of water. The disadvantage is, that the "quick water" from the wheels intensifies the friction on the after-body. In oscillating engines, where one boiler is sometimes put forward and the other aft, the engine is amidships. In case, however, the wheels are put abaft the midship section, it is necessary to keep the after-body full below the water-line, because, in passing through the water rapidly, a partial vacuum is created, and the lateral currents do not flow in fast enough to restore the original level.

In constructing a propeller, it is requisite to have very sharp after-ends, that the screw may not work in dead water, and a greater draft is needed to submerge the screw. A propeller should assimilate more to the model of a sailing ship. In a seaway, they roll much more than side-wheel vessels.

The following brief but comprehensive description of ship-building, will convey a general idea of practical construction, and while it cannot fail to interest the student, will prepare him, in a measure, for a more elaborate treatise on Naval Architecture.

The Draught. The nicest and most difficult operation in ship-building consists in forming the draught. This is usually effected by representing the form of the proposed ship in three distinct points of view. The first is called the *sheer-plan*, and

gives a complete view of the side: here are represented the length, depth, rake of the stem and stern; the wales, water-lines, decks, ports, masts, and channels. The *body-plan* shows the breadth, having described upon it every timber composing the frame of the ship; those running from the place of greatest breadth forwards being described on the right hand; those running aft, on the left. Lastly, there is the *half breadth*, or *horizontal-plan*, showing the whole as if seen from above. The construction of these draughts is exceedingly intricate and laborious; and when finished, they convey no very clear idea of the intended ship. American builders, and some of the best British builders, have a different mode, very easy and satisfactory. They begin by making a wooden model of the proposed construction, the thing itself in miniature. Here the length, breadth, bulk, all the dimensions, and most minute inflections of the whole, are seen at a single glance; the eye of the architect considers, and reconsiders the adaptation of his model to the proposed object, dwells minutely on every part, and is thus able to correct the faults of his future ship at the mere expense of a few chips, and while yet in embryo.

In a ship-of-war, the great object is speed, connected, as far as may be, with ease of movements, and capacity to accommodate her crew, and carry a large supply of water and provisions. One point, moreover, is especially to be looked to; this is, that the ship floats sufficiently high above water to run no risk of receiving seas in her lower ports, in time of action. In order to be secure of this, the constructor must make an estimate of the whole weight of the ship, including body, spars, and armament, men and munitions; and must so model the bottom, that it will have displaced an equal weight of water when it has arrived at the depth.

It has been said, that to combine all the good qualities in one ship was impossible, since some were subversive of others. Now, the only way to a close approximation to such a combination is to imitate a form which has stood successfully the test of experience. This the builder does when he forms his model, guided by a tasteful and accurate eye, accustomed to notice the forms of vessels, and to mark particularly those which have been distinguished for their good qualities.* In this way the American

* This is doubtless a good plan, but one to be cautiously followed by *soi-disant* architects, owing to the great tendency to *improve* on the original. Some change is generally suggested by which the new ship is to become a paragon of excellence; for instance, a little more sheer, a little more breadth of beam, a little more height between decks, &c., without considering how small a deviation from the original draught will alter the line of flotation, change the centre of gravity, and affect her stability, so that instead of improving, they may destroy every good quality.

builders have succeeded in uniting these conflicting desiderata in a degree heretofore deemed impossible.

Keeping, then, all the well-known principles in view, the builder proceeds to form the half-model of his proposed ship, making it of the usual relative dimensions (a quarter of an inch to the foot), and of alternate layers of pine and cedar dowelled together. When satisfied with his performance, he takes asunder the horizontal sections of plank of which the block was originally formed, and he has before him all the water-lines in miniature. Having expanded and marked these on the floor of the moulding-loft, he has all the necessary data, and proceeds to draft the entire frame. This done, pine-moulds are formed of all the different parts, and the preparatory labors are complete. The scene now changes from the moulding-loft to the ship-yard, and the builder turns his attention to the materials.

The timber being collected, the workmen, with each his mould, proceed to fashion the pieces of wood assigned them, a due regard being had to careful conversion, that no stick is hewn contrary to its grain so as to impair its strength, nor a larger one ever used than is necessary for the particular purpose; and especially, that no bad, or even indifferent wood be put in an important place, whence it could be removed only with difficulty.

Framing. The frame being ready, it is thus put together. First, the blocks are placed in the slip, and the keel laid upon them, the pieces being snugly scarfed together and bolted; the keel is also scarfed to the stem forward, and the sternpost aft, the apron being raised with the stem, and the transoms and fashion pieces with the stern, if the vessel be not large. In laying down the keel, great care must be taken to preserve its perpendicularity, for which purpose it is pinned with tree-nails on either side of the blocks; also in raising and propping the stem and stern, and every piece of the frame. It is only by extreme attention that the builder avoids producing a crooked ship—an artificial monster of by no means rare occurrence.

Floor Timbers are now let into the keel, and every other one is there firmly bolted and riveted; they are notches of trees, formed by the trunk and one of the branches. Hence, in order to have equal strength on both sides, the butts should be alternately placed to right and left. As the floor-timbers are the great connecting principles of the ship, to which they bear the same relation as ribs to the human body, too much care cannot be taken in selecting and securing them. The dead wood which fills up the angles at the stem and stern being got in, the kelson is laid upon the floor-timbers, which let into it, until it rests upon the keel; its pieces are scarfed together, and to the stemson and

sternson, which form its prolongation up the stem and stern. A bend or *frame* usually consists, besides the floor-timbers, of four futtocks and one top-timber, on each side; the first, or lower futtock, descends to the keel, beside the floor-timbers, to which it is either bolted or pinned with tree-nails; the heel of the second rests upon the head of the floor, and bolts to the side of the first; and so on up to the top timber. These, when put together, are termed a *frame*. Towards the stem and stern, the timbers do not meet the keel at right angles, but are inclined respectively forward and aft, as well to economize timber, by adapting the sticks to the inclination of the curves, as to augment the strength of parts much exposed to shocks from waves, rocks, and icebergs. Such frames are called *cant frames*, or simply *cants*, and the section where found, a cant body. The different portions of the frame are thus raised to their places by sheers and tackles, and then carefully shored, and kept to the proper breadth by cross spalls; ribands are also carried round the frame and bolted, and every precaution taken to confine each separate part to its particular position. Harpins are somewhat similar to ribands, and are put on temporarily to keep the frames in place as they are raised; hence the expression "lean or full in the harpins," as a ship may be narrow or otherwise; the term applying more particularly to the breadth at the fore channels. The frame, being now complete, is dubbed smoothly off within and out, preparatory to planking, sometimes the frame is made completely solid, and caulked; in this case the interior covering of plank is dispensed with, excepting a few strengthening streaks. This method has many advantages; a little additional width to the timbers brings them in contact, when, besides their being naked and exposed to the air within, there is no space for the generation of those destructive gases which cause dry rot. In this case, salting, which makes a ship damp and unwholesome, is also avoided.

Planking. Having advanced thus far in the construction, the next care is to proceed with the planking, which does not merely serve to exclude the water, but to protect, connect, and bind harmoniously together, and is quite as essential as the skin to the body. Though, apparently, the most simple part of this wonderful machine, it is yet very difficult. Just as, in draughting the frame, it is necessary to have in view all the ports and scuppers to be carried clear of the timbers, it is essential, in planking, to have a preconcerted plan of the whole. The butts must not come near the scarfs of the keel, nor beside each other, within or without, nor near the portholes, nor opposite the pumps. lest the oakum be sucked out, but must be judiciously distributed so as to impart equal strength to every portion. It is also one

of the nicest arts of the builder, so to carry up his planking, as with little waste, to keep his seams always fair with the water lines. When it is necessary to bend a plank at the bow or stern, it is heated by steam and then forced into place with screws and levers. While this is going on, the beams are erected and pillared on the inside plankings; the knees, which are crotches of timber or iron, confine them to the sides; also, the transoms at the angles of the stern; in like manner the breast-hooks hold the stem to the planking and cant timbers of the bow. All this being attended to, the decks, plank-sheer, and rails finished, pumps placed, the bits for securing the cable, the capstan, the catheads for suspending the anchors, hatchways, mast-holes, and a variety of other objects, which, though too many to enumerate, must by no means be forgotten—all being complete, the carpenter makes room for the caulker, who carefully stops all the seams with oakum, and smears them with pitch. The scraper follows the caulker; and water having been pumped into the hold, to ascertain whether there is any leak, the bottom is ready to be sheathed, or coppered, to protect it from the worms.

Sheathing consists simply in covering the bottom with plank, sheets of paper, soaked in hot pitch, being placed between. In sheathing with copper, paper or felt is also interposed. The plates overlap each other from bow to stern, to prevent their being stripped off by the continual shock of the passing water.

Launching. This is the triumph of the builder. It is a nice operation, and is thus performed: If there be no ways in the ship, they are immediately prepared. Two parallel platforms of solid timber are laid one on each side of the keel, at the distance of a few feet from it, and extending from the stem as far below the stern as can be reached at low water. In this position they are carefully and firmly blocked and supported throughout their length. This double platform is called the *ways*. Upon it a second system of timber is loosely laid, and well greased between. The space from these last to the ship's bottom is everywhere filled with wedges of soft wood, fashioned to its curves. The whole is called the *cradle*. The extremities of the cradle at the bow and stern, are bound tightly across the keel with chains or ropes, and it is further kept from spreading by stout mouldings, which overlap the outer edges of the ways. When the rising tide has reached well up the ways, the wedges are simultaneously driven on every side, and the ship is raised from the blocks on which she has hitherto rested, and made to repose entirely on the cradle. The shores are all removed except the two shores planted against the counters, and when the proper moment has arrived, these are also knocked away. The

vessel, now abandoned to her weight, and encouraged by the yielding of the grease, begins slowly falling on the inclined plane; her motion becomes at each moment more and more rapid; the ways smoke and ignite with the pressure and velocity of the moving mass, and in a twinkling the noble fabric is upon its destined element.*

An improvement in naval architecture, may be said to consist in what is technically termed the *filling-in* of the timbers. The opening between the ribs are filled in with slips of timber nearly to the height of the orlop, or lower tier of beams; which being then caulked, and paid or pitched over, makes the frame from head to stern, and within a few feet of the greatest draught of water, one compact and water-tight mass of timber; so that were any of the outer planking of the bottom to be knocked off, the ship would not only still keep afloat, but would be secured from sinking. In the old system the starting of a plank would be and often has been fatal. The mode of filling in these openings between the frame, where the width of the space does not exceed three inches, is by driving in slices of wood cut wedge-like; two of which being driven, one from the outside, the other from within, form the paralleled space of the opening, thereby bringing the parts into the closest contact. In the openings exceeding the width of three inches, the space is occupied by pieces corresponding with the openings, the fibre of such pieces being laid in the same direction as that of the frame timbers.

These fillings occasion no consumption of useful timber, as one fourth of the produce of slab and other offal now sold as fathom wood, would supply a sufficient quantity for the consumption of the whole navy.

The advantages obtained by filling in† the openings are these; —to add to the strength and durability of the fabric; to pre-

* The writer of this article thus concludes his brief description of Launching: "Among the ancients, a launch was ever an occasion of great festivity. The mariners were crowned with wreaths, and the ship bedecked with streamers and garlands. Safely afloat, she was purified with a lighted torch, an egg and brimstone, and solemnly consecrated to the god whose image she bore. In our less poetic times, there is no lack of feasting and merriment, though instead of the torch, the egg, and the brimstone, the oldest sailor breaks a bottle of rum (unless, indeed, he may have slyly substituted water as more appropriate to a christening) over the head of the emblem—still, perchance, the image of father Neptune or Apollo." The *billet-head* has, with us, almost entirely superseded the figure-head.

† H. B. M. ship "Orestes" struck upon a sunken rock on the coast of Portugal. By this accident *eighteen* feet of the main-keel from the main-mast forward was knocked off, close up to the garboard streak. During a passage of eight days, to Spithead, the ship made no more water than four *inches* per hour. Had the timbers of the "Orestes" not been "*filled in*," the probability is, that the ship would never have reached a British port.

serve the health of the crew from the effects of the impure air arising from the filth which soon collects in these openings; to render the ship less liable to leakage, as well as to facilitate the stoppage of any leak; and lastly, to increase, as it may be said the thickness of the bottom from four or four and a half (the usual thickness of the plank) to about sixteen inches, thereby lessening very considerably the danger to be apprehended from getting on shore, or foundering at sea. That it tends also to the durability of the ship, will be inferred from the following positions:

1st. That the openings in the old principle are, after a ship has had any considerable length of service, choked up in many parts with an accumulation of filth.

2dly. That no free circulation of air can be obtained in these openings by any means.

3dly. That timber being either freely exposed to or excluded from the air is equally preserved.

4thly. That it has been found, on examining the frame and plank of old ships, that those parts (now filled in) generally decay sooner than the rest, viz., from the floor-heads in the midships, and from the dead-wood forward, and abaft to the height of the orlop clamps.

The Model is a feature peculiar to American ship building. Models were made in Europe as early as the middle of the last century; but they were what would be recognized as the skeleton model, made of pieces representing the half frames, and were neither adapted to the purposes of building, or of exhibiting the lines of flotation. The invention of water-line models was the result of accident. In the Eastern States, and in the British provinces, men who were unacquainted with the art of constructing upon paper, made, from a block, the form of the vessel they intended to build, which was cut in several transverse sections. Those sections, representing frames, were then expanded from the scale upon which the model was made, to the size of the vessel; and frames were worked out to which harpins were attached, and the intermediate spaces filled in by making moulds to those harpins. In making one of those block models, the block was found to be too small to give the required depth; a piece was therefore added, and when finished it was discovered that the longitudinal form of the vessel was shown by the line uniting the two pieces together. The question at once arose, if one seam was an advantage would not two be a still greater. Hence, as early as 1790, water-line models were made for building purposes.

MODELS.

There is still preserved in the rooms of the East India Marine Society, at Salem, Mass., the model of a ketch called the "Eliza," one hundred and ninety tons burden, which was launched in June, 1794. This model was made in three pieces by the scale of one quarter of an inch to the foot: eighty-four feet keel, twenty-four feet beam, and nine feet hold. The model has been preserved on account of the remarkable sailing qualities the vessel possessed. The "Eliza" and the celebrated frigate "Essex," were both built at Salem, by the same constructor.

The "Ohio" 74, was built from a model under the supervision of Mr. Henry Eckford, at the Brooklyn yard in 1820, and since that time the model has been considered an indispensable feature in the designing of a ship.

In giving the method of constructing models, it will be assumed that the eye is the only guide in giving the form, having decided upon the particular kind of vessel wanted. The dimensions of the ship, and the altitude of the load-line of flotation above the base-line being known, the portion between these lines may be divided into equal or unequal parts, as occasion may require. If the ordinary mode is adopted, of making the alternate sections of cedar and pine, the lowest piece should be of cedar, because it presents to the action of the file the largest surface, and is more easily made fair than pine. If the ship is to have but little dead rise, the lowest piece should be the thinnest, on account of having a line at the lower part of the bilge, which facilitates the laying off on the floor of the mould loft. In determining the altitudes of the load-line of flotation, it does not arbitrarily follow that the model shall have no parallel pieces above this line, the effect of which is to reduce the thickness of the first sheer piece. The proportions of depth of ships are calculated from the base-line or top of the keel to the lower side of the plank sheer, or, as it is sometimes called, covering board; and, as a consequence, one sheer line should be shown on the model at this height, measured on the greatest transverse section. The whole number of pieces may be confined with dowels running perpendicularly to the surface, or they may be screwed together in layers. As the model represents but half the ship, as a consequence, one side must present a plane which must be perfectly fair; and upon this plane the sheer plan is projected in lead pencil. This plan, which is the first laid off, whether on the model or on the floor, is bounded by the base-line, the rabbet* on the stem and that of the stern-post; and the upper sheer which is regarded as the lower side of the rail; hence it follows that the

* The Rabbet is the groove wherein the hood-ends (ends of the outside planks) fit.

MODELS.

sheer-plan determines the length of the ship, and the heights at the several sheers and water-lines, or parallels to the line of flotation. The materials for the model having been arranged and secured, either with screws or dowels, and the plane, representing the middle line, made perfectly fair, we may dress the opposite side parallel to the first, setting off, at certain intervals, the half-breadths of the intended ship. With regard to the position and shape of the greatest transverse section, much has been said and written, and after all it is left somewhat in doubt. From 4 to 6 degrees of rise for steamers, and as much as 8 degrees for sailing vessels, gives an easy bilge, and while it insures stability, prevents rolling. With regard to location, some of our best builders, not many years since, placed this point only one third of the length from the stem. Abstractly, it would seem most important that the bow should be adapted to divide the water with the least possible resistance; but experience has proved that it is far more essential to facilitate the escape of the displaced water along the side of the vessel; for when once a passage is opened for the ship, the fluid tends to reunite abaft the point of greatest breadth, where, instead of offering resistance, it presses the ship forward, in its endeavor to recover its level and fill the vacuum constantly opened behind her. Without recurring to Sir Isaac Newton for the demonstration by which he has shown the mathematical truth of this principle, it may be sufficient to instance the fact familiar to every seaman, that a log tows much easier by its bigger end;* nor do we find a trifling concurrent testimony in the forms of the finny tribe, which an unerring nature has adapted to divide the element they move in, by a shape gradually diminishing from head to tail. As it is then less essential that a ship should be sharp forward than aft, there is a further advantage in having the bow full towards the edge, that it may check her in descending into the waves—not abruptly, but gently—pitching being the most dangerous to hull and spars of all a vessel's movements, as already stated. But however sound this reasoning, the midship section has been gradually working aft, until, in some of our fastest clippers, it is found *abaft* the centre. After settling upon the greatest transverse section, as judgment may dictate, the model is worked off until it suits the eye and taste of the architect.

Many useful discoveries may be made by models; and from experiments with them, carefully conducted, results may be obtained with as much certainty as by the nicest calculations—at all events, such as may serve as a check upon them.

* This is a mooted point. One very good authority remarks, "Whatsoever theorists may say, we find that practical men always tow a spar by the *smaller end*."

MODELS.

To Find the Centre of Gravity. It is only necessary to dispose the model, which for great accuracy may be made without screws or dowels, successively in two positions of equilibrium. Insert a tack in the surface of the plane representing the middle line near the extreme point of intersection of rail with knighthead, from which suspend the model by a line; hang a plummet from the same point of suspension, and when at rest mark the intersection of the line with the plane; the model may now be suspended from the other extremity, at the intersection of the rail with the stern, and the centre of gravity will be found on the plane, at the intersection of the two lines thus found.

The same process may be resorted to in determining the centre of buoyancy, by separating the model at the load, or any line of flotation below which the centre of displacement is required.

The *displacement* is obtained by the following simple method, on the principle that the weight of a floating body and the weight of the water it displaces are equal. A water-tight vessel, having a small pulley in the bottom, is filled with distilled water in sufficient quantity to float the model, which is placed in the fluid and drawn down by the pulley to its proposed line of flotation. A faucet previously arranged, permits the exact amount of water displaced to run out into the bowl of a nicely-adjusted pair of scales, and the weight of water displaced by the half model, and by an easy computation the whole ship, may be thus obtained.

CHAPTER XIII.

THEORY OF RIGGING SHEARS AND SUPPORTING LOWER YARDS—HOISTING IN GUNS, BOATS, AND ANCHORS.

Observations on the Theory and Practice of Rigging Shears, and on the Manner of Supporting Lower Yards for the purpose of Sustaining Heavy Weights. In the complicated duties of the naval officer, he has in numerous instances the responsibility of lifting heavy weights, such as boats, anchors, heavy guns, spare propellers, mortars, and many other things of similar character, which are generally raised by a tackle, or purchase, on the lower yard; but as this method involves the safety of the spars, it appears desirable to examine and consider the subject in all its bearings, in order to determine, upon mechanical principles, which is the best and safest mode of lifting any weight.

The strain upon a lower yard by the suspension of a weight, varies according to the angle at which the yard may be placed, and the manner of supporting it, either by topping-lift guys, or by a shore from the deck; and as a difference exists in the various methods generally adopted, it is purposed to show a sure means of ascertaining, first, the actual strain which any given weight will produce upon the supporting guys, according to their position; and, secondly, the whole amount of downward, or crushing pressure, which the yard or spar used for the purpose will have to sustain.

As a general rule, in supporting a yard, derrick, or shears, the *supporting guys should be attached to the yard or spar, at the spot from which the weight is to be suspended.*

Fig. 354, Plate 57, will explain the character of the leverage here described.

The weight w attached to a derrick *a a* above the guys *i o*, constitutes a lever of the first kind, with the fulcrum between the power and the weight. The weight *w* attached to a derrick below the guys, constitutes a level of the second kind, with the weight between the fulcrum and the power, and in either case the instrument is weakened, in proportion to the distance between the back support (which in this instance is the fulcrum)

and the weight. On the contrary, let the weight be attached to the derrick at *o*, and the whole strength of the material employed will be obtained.

This rule holds good in all cases, whether it be a lower yard, derrick, or shears, to be supported.

Fig. 355, Plate 57, represents a weight of five tons suspended from the lower yard of a frigate, and is intended to illustrate the effect it would produce upon the guys, and upon the yards; but as it is improbable that a weight of five tons would actually be suspended from a yard in such a weak position, it is merely drawn for the purpose of illustrating an extreme case. The guy A B would be in a better position, and afford greater security to the yard, if it was carried up to the lower cap; but as the lower mast-head is not supported by either shrouds or stay, and depends entirely upon the diameter and strength of the wood, it is deemed unsafe to attach much additional weight to the cap, particularly as instances have been known when the foremast head was broken short above the eyes of the lower rigging, solely by the weight of the bower anchor being suspended to the quarter of the fore-yard, and the strain carried up to the cap by a guy. It is recommended that the guy (A B) be attached to the mast-head immediately above the lower shrouds; or if it should be secured to the cap, then it is absolutely necessary that the mast-head be well supported to bear the additional strain.

All the information which can be derived from the consideration of this example as illustrated by Fig. 355,* and indeed the foundation of the rule to the whole question, is to be found in the triangle D A W. The perpendicular A W represents the weight five tons; W D, drawn parallel to the supporting guy A B (and which in every case is necessary to be observed), represents the strain upon the guy to be fifteen tons; and D A, the remaining side of the triangle, is the measure of the crushing pressure upon the yard amounting to fourteen and a half tons.

As the known weight to be lifted determines in all cases one side of the triangle, and the direction of the guys and the position of the yard or derrick give the angles, the solution of the other parts of the figure may be determined, by arithmetical

* The scale of feet attached to Fig. 355, Plate 57, applies also to Figs. 356, 357, 358, 359, and 360.

PLATE 58

Fig. 356

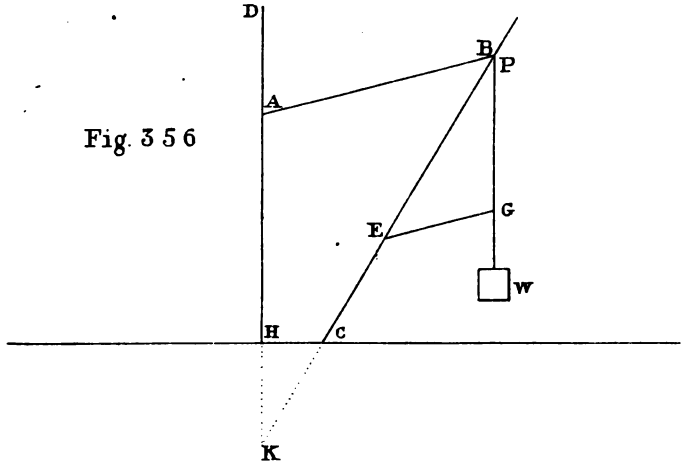
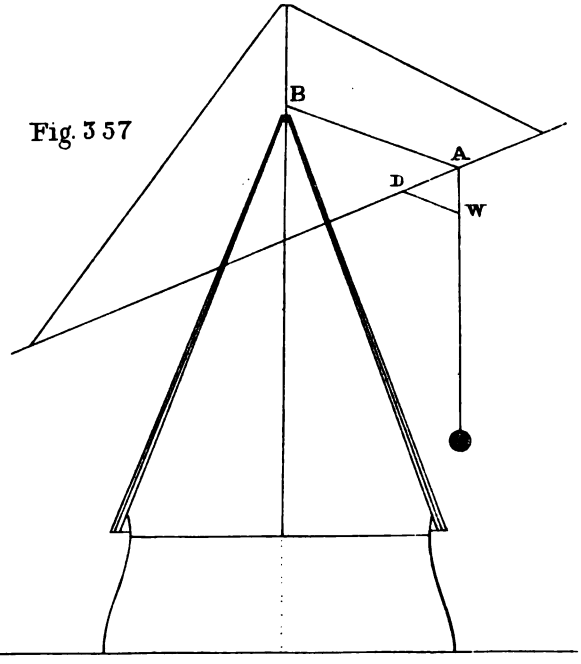


Fig. 357



calculation, as a plain question in trigonometry; thus in Fig. 356, Plate 58 :—

Let a weight W be suspended from any point P in a derrick C B, which is supported by the guy A B, fixed to the mast H D.

In the vertical line through P, take any length P G to represent the weight W; through G draw G E, parallel to the guy A B. Produce A H, B C to meet in K.

Then P E will represent the pressure on the derrick in the direction of its length; and G E the force of P in the direction of the guy A B.

Then P E, or pressure on derrick in the direction of its length $\Big\} = W \times \frac{K\,B}{A\,K}$

$$\text{or } W \times \frac{\text{sine } K\,A\,B}{\text{sine } A\,B\,K}$$

$$\text{Tension on the guy } A\,B = W \times \frac{A\,B}{A\,K} \times \frac{C\,P}{C\,B}$$

$$\text{or} = W \times \frac{\text{sine } A\,K\,B}{\text{sine } A\,B\,K} \times \frac{C\,P^*}{C\,B}$$

Force perpendicular to the mast head at A

$$= W \times \frac{A\,B}{A\,K} \times \frac{C\,P}{C\,B} \times H\,A \times \text{sine } B\,A\,D$$

But it may also be accomplished in a very simple way, with sufficient accuracy, by constructing a figure upon paper, which will answer the same purpose, and allow all the various parts to be measured upon a scale.

By this example, it appears that the strain upon the guy, and likewise on the yard, amounts to nearly three times that of the weight lifted, evidently caused by the very large angle of ninety degrees difference between the vertical direction of the strain and the horizontal position of the yard; therefore the nearer these two lines can be made to approach each other, the less excess of weight will the guy and the yard have in all cases to sustain.

In proceeding with the consideration of this subject, and in order to render it clear, the next reference will be to a lower yard in the position in which it is generally placed in ships-of-war, for the purpose of lifting a heavy weight.

* C P and C B, are not necessarily equal.

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In Fig. 357, the yard is placed at an angle of twenty-two and a half degrees from the horizontal line, the weight suspended is five tons, the same as in the former case; the strain upon the guy A B is now seven tons; and the crushing pressure on the yard is six and three quarters tons.

In Fig. 358, Plate 59, the yard is placed at an angle of forty-five degrees, the utmost limit of elevation that can be obtained. The weight suspended is five tons as before, and the strain upon the guy is now reduced to four and one quarter tons, and the downward or crushing pressure to five and a half tons.

It is scarcely necessary to observe, that a perpendicular position is superior to any other that a pillar or spar can be placed in, for the purpose of sustaining a heavy weight. The downward pressure in such a case, is in the direction of the grain of the wood, all lateral strain is avoided, the supporting guys are relieved, and the actual weight of the substance lifted, together with the amount of friction produced by the operation, is the only calculation necessary.

The result of the preceding examples on the various modifications of the position of the lower yard, not only confirms this fact, but illustrates the advantage gained in strength by every step from the weak horizontal position towards the perpendicular; but as the angle of forty-five degrees shown by the last example terminates the beneficial range of the lower yard, it becomes necessary to investigate such other available means for the service in question, as the resources of a ship can supply.

The Derrick. By examining the character of a derrick, no doubt it will be found to possess advantages so valuable, as to render it superior in many respects to a lower yard for the purpose of lifting a heavy weight. The principal advantages are, that it transfers the whole weight to the deck, which can be well supported by shores below, it relieves all anxiety about the safety of the mast and yard, and it can be placed vertically, or at any angle most suitable to a particular case. It can be supported without any difficulty either with or without the aid of a mast; it is very soon rigged and ready for use, and as quickly dismantled. These advantages are sufficiently numerous to recommend it for general use in all cases where strength is required.

And on the subject of providing the means;—few ships go to sea without a spare topmast, the diameter of which is larger than the lower yard-arm; it is very strong, being nearly as large at one end as the other, and is in every respect well calculated *for a derrick.*

PLATE 59

Fig. 358

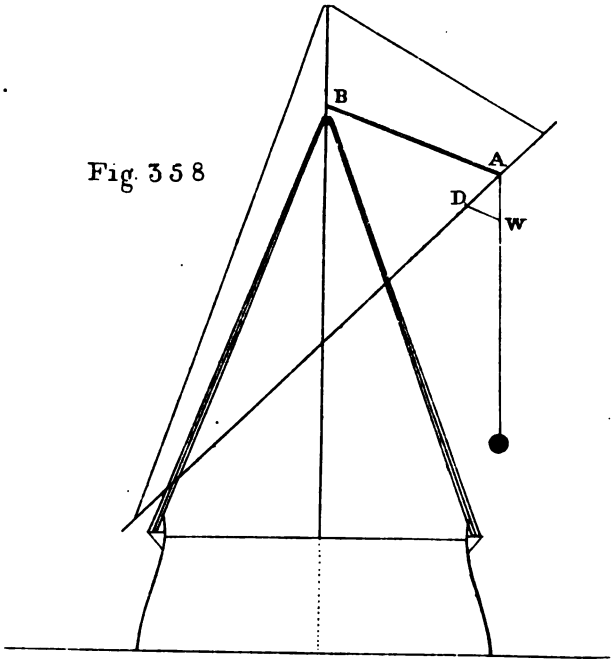


Fig. 359

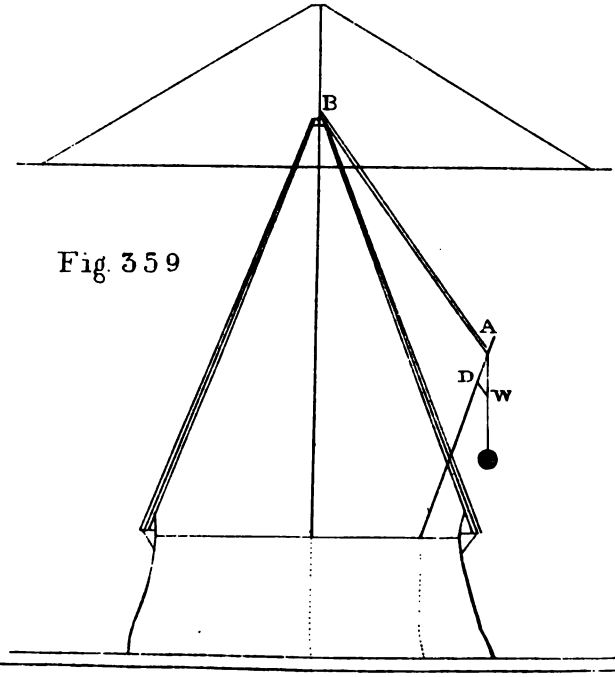


PLATE 60

Fig. 360

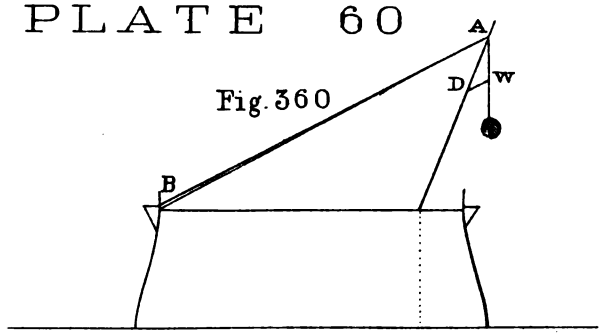
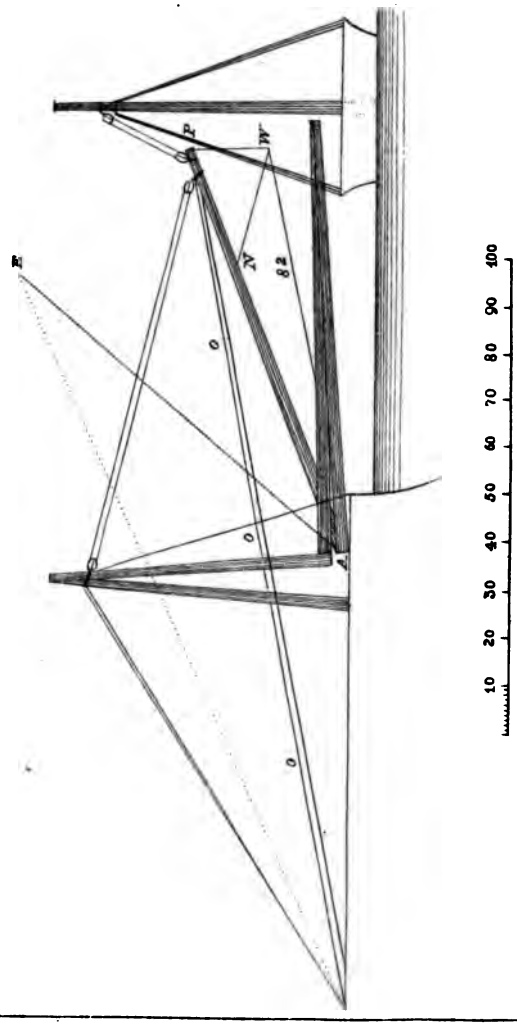


Fig. 361



The ropes necessary to sustain it in its position, and the purchase block for lifting the weight, may be secured to the spar at any height above the deck, without either cutting the spar, or nailing on cleats, as by a well-managed arrangement of lashings, all slipping or shifting of position may certainly be prevented.

In Fig. 359, Plate 59, the derrick is twenty-six feet long, and is rigged at twenty-four feet above the level of the deck; it stands at an inclination of twenty degrees, but has the same projection as the examples with the lower yard. The weight is five tons, the strain upon the guy is two and a half tons, and the downward pressure is four tons, in addition to whatever amount of friction may be produced by raising the weight.

With reference to what has been stated, that in the event of a derrick being placed in a perpendicular position, the downward pressure in such a case would amount to the actual weight of the substance lifted, with the amount of friction, whatever it might be, added to it; in the last example the downward pressure is found to be less than the actual weight of the substance lifted, and may appear inconsistent if not explained. The cause is to be found in the great elevation of the derrick (about seventy degrees) and the near approach of the supporting guys to the perpendicular position; the weight being partly sustained by the guy and the derrick combined; the more the derrick approaches the perpendicular, the less will be the strain upon the guy, and this strain will not be felt at all, when the derrick is vertical, as has been already stated.

In Fig. 360, Plate 60, we have an example of a derrick on a ship's deck supported without a mast.

In this case the derrick is twenty-five feet long, the rigging twenty-two feet above the level of the deck, and the inclination twenty-one and a half degrees; the weight is five tons as before, the strain on the guy is three tons, and the crushing pressure is seven and a quarter tons. The main and principal difference to be noticed in this case is the direction of the guy, which, being below the horizontal line, adds considerably to the crushing pressure; in all the former cases, except the first, the guy was above the level, and relieved the downward pressure.

All the preceding examples have reference to a vertical strain in raising a weight, but there are many cases where the derrick or shears are necessarily placed some distance from the weight, and, consequently, the direction of the strain is at a considerable

THE DERRICK.

angle with the perpendicular. A formidable weight of the kind was raised in the Woolwich dock-yard, which will afford an opportunity in the necessary illustration, of explaining some important facts connected with this particular kind of strain, not included in the preceding examples.

The weight here alluded to, consisted of two masting spars of the largest dimensions converted into a pair of shears, intended when erected and complete, for the purpose of lifting heavy boilers into or out of steam-vessels; each spar being upwards of ninety-one feet long and twenty-nine inches in diameter, connected together at the top by a cross-beam through cast-iron sockets, and separated thirty feet at the bottom. The weight to be lifted, by raising the upper end of these shears, including the necessary iron-work to connect them to each other, was estimated at fifteen tons—that is, fifteen tons perpendicular weight, independent of that which might be produced by leverage. But as these spars projected eighty-two feet beyond the coping of the wall over the surface of the water in the basin, no means could be devised to insure the lifting strain in the perpendicular direction, except in the first part of the operation to a very limited extent, by the aid of a vessel's mast; they were therefore raised to the point P, in Fig. 361, Plate 60, by that means; and the usual mode of proceeding towards the vertical position would be by the guys *o o o*. This, however, on account of the immense leverage is nearly impracticable, as will be seen by the triangle A P W. P W represents the weight, fifteen tons; A W the lifting strain, eighty-two tons; and A P the crushing pressure, eighty-five tons.

To prevent the risk of accident, it was not deemed prudent to attempt this enormous weight, and therefore a temporary pair of shears was set up immediately behind the heel of the large spars, and a purchase applied fifty-five feet above the level of the ground; the lifting strain by the aid of these shears, as shown in the triangle N P W, is reduced to twenty-five tons, and the crushing pressure to twenty-six tons.

This strain being little more than one quarter the amount of that which the usual mode of proceeding would have produced upon the guys *o o o*, all difficulty and danger are avoided. The spars are raised to the position E, by the purchase on the temporary shears, and as every degree of elevation reduces the lifting strain and the horizontal or crushing pressure in proportion, the guys *o o o* become more efficient in bearing, being in the right position to finish the operation.

It has been mentioned before, that the dimensions of the tri*angle do* in all cases determine the amount of strain which a

given weight produces upon the guys, and upon the derrick, or shears, whether the lifting strain be perpendicular or not; and if the materials which are in use can, by any contrivance consistent with safety, be so arranged as to reduce the length of each side of the triangle, the strain upon the guy, and upon the spars, will be reduced in proportion.

The Span. From the manner of using stay tackles, and the extra duties lower and topmast stays are called upon to perform (the latter being used for hooking sail-burtons to), it will be proper in this connection to introduce a few remarks on the nature and properties of the *Span*.

Suppose a ship* to be moored with one hundred fathoms of cable to each bower anchor in an east and west direction, as in Fig. 362, Plate 61, and that in calms or light winds she would ride in the direct line between the two anchors, as at A. With the wind at east or west she would of course be sustained in position by the strength of one cable; but the seaman who does not consider the subject theoretically might be led into the supposition, that, with a south wind blowing in the direction of the arrow, the ship then, as she rides between the two anchors, would be sustained by the strength of two cables. This is an extremely deceptive and fallacious idea, calculated to favor the notion of security at a time when the position is the weakest and most unsafe in which a ship can be placed. In mooring a ship, there are generally a few fathoms of slack cable, sufficient to admit of her falling to leeward of the direct line between the two anchors, when the wind blows at a right angle with that line, as in the case here alluded to; and in order to illustrate the subject properly, the amount of support which the two cables would afford to the ship in each of the positions B C D F G N in the figure, has been calculated, and as these results are geometrically obtained, they may be depended on. It is improbable that a ship could be maintained in the position B, at the small angle of five degrees, even under the force of a moderate breeze, and with the unyielding character of chain to ride by; but supposing it to be possible, then the whole amount of support which the two cables would give to the ship is .174 parts, or about one sixth of the strength of one cable and no more. At the angle of ten degrees in the position C, it would amount to .347 parts; at the angle of fifteen degrees, in the position D, it would amount to .517 parts; at the angle of twenty degrees in the position F, it would amount to .684 parts; at the angle of twenty-five degrees in the position G, it would amount to .845 parts; and in the position N, at an

* This subject seems to belong properly to the Chapter on Mooring, but it will be sufficient if we revert to these remarks when in that part of the course.

angle of thirty degrees, it would amount to the strength of one cable; that is, one cable laid out in the direction of the wind at south, would yield the same support to the ship as both the bower cables do in the position N; for as N W, N E, represent the two cables, so N S likewise represents the amount of support in that position. It is evident that, by veering a long scope of these cables, a greater angle and a consequent nearer approach to the strength of two cables will be obtained; but it is necessary to observe that, by a peculiar law of mechanics, two parts of a rope which are not parallel, or two ropes connected together as the cables are by the ship, and equally strained in the same direction as the ship strains the cables, do not possess the full strength of two parts; therefore, as the wide-spread position of the anchors renders it impossible that these cables can become parallel even with a long scope, so the full strength of two cables under such circumstances is not attainable. In explanation of this part it is necessary to refer again to Fig. 362, where it will be perceived that as N S represents the amount of support to the ship, with the cables at a certain angle, so N S would always represent the strength of a similar span at any other angle, it being the key to the question—the measure of the force employed as well as of the strength of the resisting material—and as N E, N W, represent the two parts of a span, N S must be less than those two parts combined, under any circumstances, however great the angle; and consequently, two parts of a rope or chain forming a span which cannot become parallel although they may only differ from the parallel by a very few degrees, must be weaker than the full strength by the amount of that difference. This theory is capable of practical proof, and has been proved by many experiments in the testing machine. These experiments have been made at different angles, and with rope of various sizes, but a description of one or two may be sufficient for the present purpose.

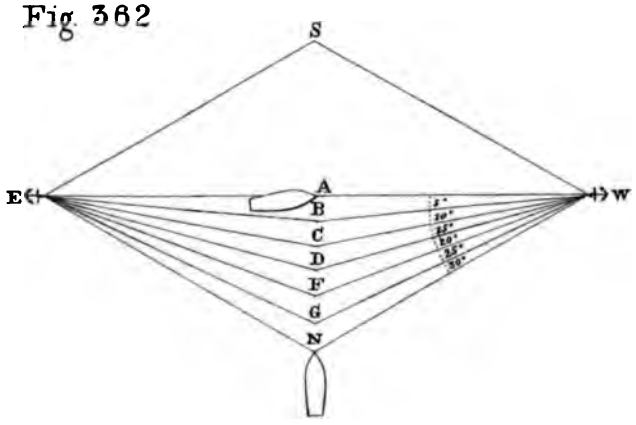
Fig. 363, Plate 61, illustrates the method of experimentally proving the strength of a span.

The beam A is attached to the lever of the testing machine by the clamps B B, and the middle of the rope is drawn from the beam by the power attached to the clamp C; the distance which the rope is drawn from the beam before it breaks is shown in inches on a scale fixed to the beam, and this determines the angle.

It was ascertained by three experiments, that the mean average strength of a piece of four-inch hawser laid rope was six and three quarters tons. The same rope when strained as a span in the testing machine, similar to Fig. 363,

PLATE 61

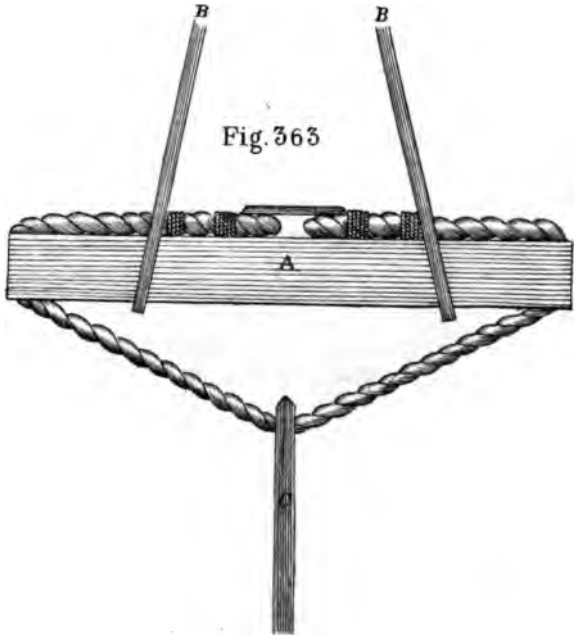
Fig. 362



Scale of Fathoms.

10 20 30 40 50 60 70 80 90 100 200

Fig. 363



broke in the first experiment when at an angle of thirty-one and a half degrees, at a strain of seven tons.

In the second experiment, a piece of the same rope, when at an angle of twenty-nine and a quarter degrees, broke at a strain of six and a quarter tons.

A more satisfactory proof of the theory than that afforded by these experiments can never be expected, as they strictly coincide. In this case the excess of strength by experiment at the angle of thirty-one and a half degrees over that at twenty-nine and a quarter degrees is in exact accordance with the theory. Many other experiments have been made with pieces of rope of various sizes to determine this question, and in every case it has been clearly proved that where a span is so placed as to have a less angle than thirty degrees, the strength of the two parts of rope or chain of which it is composed, is less than the strength which one such part would have, if placed in a direct line with the strain. The manner of mooring ships-of-war, here described, is not practised now to anything like the same extent, as when hempen cables were exclusively used; but the facts which have been experimentally proved in confirmation of the theory, are of sufficient importance to excite attention to the subject whenever it may be necessary.

The same argument is equally applicable to the use of a span in many other positions, such as that from the mainmast to the head of the foremast of a ship, for the purpose of attaching tackles to hoist in boats, instead of the old method of fixing them to the mainstay. Should this span form a direct line from one mast to the other, the strength of it when strained downwards in the middle will be very trifling, notwithstanding the rope may be large and of the best quality. It is therefore quite certain, that the greater the dip or downward deflection, a rope in this position may have in the middle, the stronger it will be, although, when curved down to the deck, it cannot much exceed the strength that one part of it would have, if placed in a vertical direction.

There is no position in which a span can be applied that does not require great care and attention; but it is particularly the case when they are used round such substances as are of a square form with projecting corners, a steam-boiler, for instance, to which they are very commonly attached, either for the purpose of vertical suspension, or horizontal removal along the ground. As chain is more frequently used on these occasions than rope, it requires still more care on account of non-elasticity, and the unfair strain by lateral pressure, to which some of the links are liable at the corners of the substance, and in the middle of the

span, where the power is applied. As these boilers are of large dimensions, it is more probable that the span will be used at a small angle, an additional reason for precaution, and one which renders it more advisable to refer again to Fig. 362, where it will be found, that the single part of a rope or chain, round a substance of this shape, and used as a span, at an angle of thirty degrees, is stronger than the same rope or chain would be if passed twice round, and the double part used as a span at fifteen degrees.

It is to be understood in discussing this subject, that, although, spans in general are so objectionable, on account of extreme weakness, which renders them dangerous in practice, yet in numerous instances they cannot be dispensed with, as no other means can be applied to meet the difficulty; their use in various positions is unavoidable, but in order to prevent the numerous and in some cases fatal accidents which occur, it is necessary to investigate the peculiar character of a rope in the position alluded to, that by the evidence of established mechanical laws the reader may be able to understand why the small force of a few pounds, applied to a rope or chain when in use at an obtuse angle, shall produce the astonishing strain of eighteen hundred per cent. upon it. This may in a great measure be explained by Fig. 364, Plate 62.

Let a rope be extended from A to B with any degree of tension; if a force, however small, be applied at any part of the rope, in any direction out of the line A B, it will cause a deflection, and increase the tension on the rope.

Let the force F be applied at C in the direction D C F, and let the rope take the position A C B. Let any length C D represent the force F, draw D B parallel to A C, and D E parallel to C B. Then C B will represent the tension produced by F on the part C B of the rope, and C E that produced on the other part of the rope A C.

$$\text{E C} = \text{F} \times \frac{\text{sine D C B}}{\text{sine A C B}}$$

$$\text{and C B} = \text{F} \times \frac{\text{sine D C A}}{\text{sine A C B}}$$

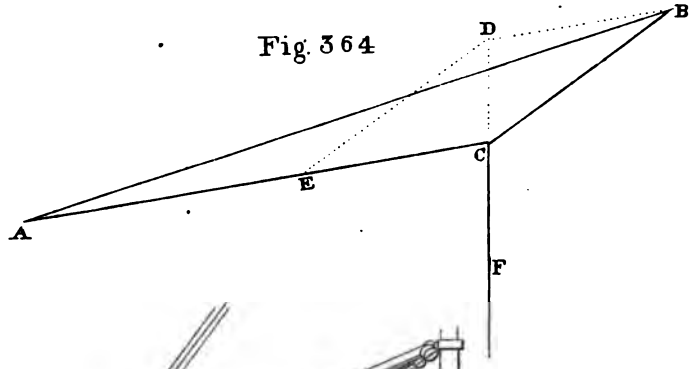
Suppose F be taken=10lbs.; the angle A C B=175°; and D C B =50°; then the angle D C A will=125°, and E C, or the tension on the part A C of the rope =

$$10\text{lbs.} \times \frac{\text{sine } 50^\circ}{\text{sine } 175^\circ} = 10\text{lbs.} \times \frac{0.7660444}{0.0871557} = 10\text{lbs.} \times 8.78 =$$

87.8lbs.

PLATE 62

Fig. 364



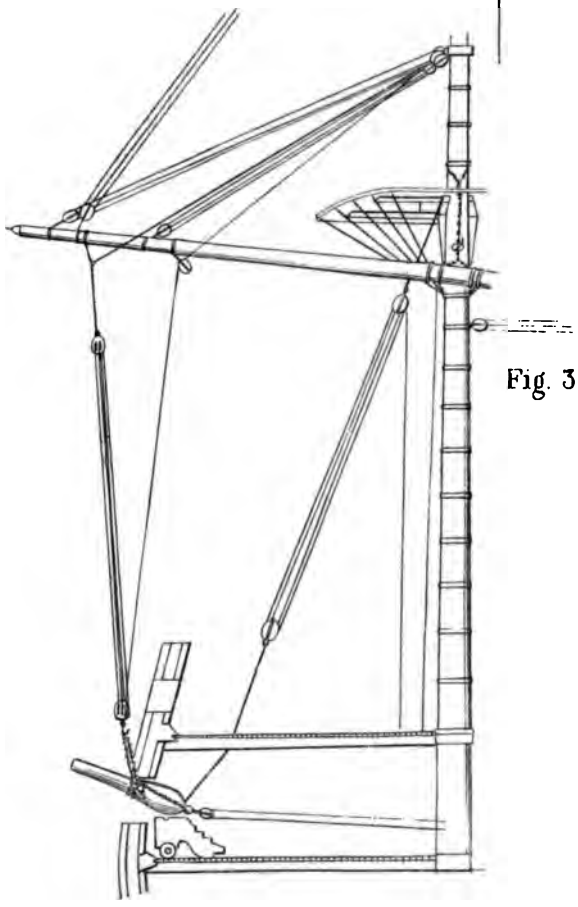


Fig. 365

THE SPAN.

C B, or the tension on the part B C of the rope=

$$10\text{lbs.} \times \frac{\text{sine } 125^\circ}{\text{sine } 175^\circ} \left(\text{or } 10\text{lbs.} \times \frac{\text{sine } 55^\circ}{\text{sine } 5^\circ}\right)$$

$$= 10\text{lbs.} \times \frac{0.8191520}{0.071557} = 10\text{lbs.} \times 9.39 = 93.9\text{lbs.}$$

Hence, the greater the obtuse angle A C B, the greater the tension on the part A C, or C B, or on both parts, according to the direction of the force applied.

If the force F, and the angle A C B, be supposed to be constant, the effect of varying the direction of the force may be seen.

Thus if D C F, the direction of the force, bisects the angle A C B, the tension of A C is equal to that of C B; and the tension on the whole rope A C B is a maximum.

Again, if D C F be perpendicular to the part A C of the rope, the maximum tension is produced on the other part C B; and if D C F be perpendicular to C B, the maximum tension is produced on the part A C of the rope.

It will be seen by this example that the small force of 10lbs. applied to this span produces an effect of 87.8lbs. upon one part of the rope, and 93.9lbs. upon the other part, the whole effect being 181.7lbs., that is, upwards of eighteen times the force applied. A still greater effect might be produced by a more obtuse angle; but sufficient has been done to show, that, by the information to be obtained in the table, page 53, of the strength of materials, any person having previously ascertained the weight of the substance to be lifted, may easily calculate beforehand all that is requisite to insure safety; and if the weight of the substance to be lifted is not certain, there can be little difficulty in estimating it sufficiently near for the purpose. It is probable, that, in a confined situation, want of space may compel the use of a span at a very small angle in lifting a weight; but this only proves that, as weakness is incurred by the smallness of the angle, safety may be insured by an additional number of turns with the lashing which forms the span; so that by the length of the span, or by adding more parts, accidents may always be prevented. In several other cases of spans used in ships, all such shrouds and backstays as have the two parts much separated at the lower end may be mentioned. It is very true that the downward strain put upon a shroud or backstay in setting it up, is in a direct line with the rope itself; but then, again, the upward pull which the leverage of the mast brings upon each pair of shrouds afterwards, is exactly similar in character to the strain which the ship exerts upon the cables as a span in Fig. 362; only that, in the case of the shroud, it is at a small angle.

SECURING LOWER YARDS.

It frequently happens that a pair of shrouds are so placed, that one part is set up to a dead-eye before the port-hole of a gun, and the other part abaft the port, the horizontal distance between them being sometimes six or eight feet. This in itself does not weaken the shrouds much, but taken in connection with the angle caused by the eye above, it is seriously objectionable, as it produces a severe strain upon the seizing, and an equally severe and injurious pressure upon the rope.

If we take, as an example, the mainmast of a small frigate, the length of shroud from the eye-seizing down to the channel will be about fifty-nine feet; the horizontal distance from one dead-eye to the other, where a gun-port intervenes, will be about six feet, giving an angle of eighty-seven degrees to each leg of the shroud; but above the upper seizing, each part of the eye leading round the corners of the masthead has an angle of forty-five degrees, the effect of which is much greater than may generally be imagined.

The circumference of the shroud-rope is nine and a half inches, the strength by experiment fifteen tons, and when the two parts are strained parallel, the strength will be thirty tons; but by the deviation from the parallel line above, and likewise below the seizing, the strength by calculation is only 21.2 tons. Unfortunately, no remedy can be offered for this evil, except that, in most cases, the spreading of the parts of shrouds and backstays so far from each other at the lower end may be prevented.

The eye of the shroud which causes the greater angle, and which gives all shrouds and backstays the character of spans, must remain as it is, because no other method so appropriate in every respect can be devised for attaching shrouds and backstays to masts.

Many other cases of spans used in ships might be mentioned, but the chief desire is to excite attention to the subject.

THE PRACTICE OF SECURING LOWER YARDS.

It is an important matter, in hoisting on board any article, to have the yards, on which are the purchases, well secured, that the yard may not be sprung, or the rigging endangered.

The fore and main yards are used for this purpose, in rigging which, there should be straps with thimbles placed within the shoulders of the yards, or an iron band with an eye, for the burtons. To these straps are hooked the single blocks, and to eye-bolts in the lower caps or to the burton pendants, the double blocks, of the burtons (the fall leading on deck). These are for the purpose of relieving the lifts, and are hauled taut to bear an

SECURING LOWER YARDS.

equal strain with them. In hoisting in any heavy article, as a gun or an anchor, two or more burtons are used, all being hauled equally taut. In hoisting in boats, or articles of less weight than anchors, guns, or a launch, it will be sufficient to use but one burton, in addition to the lift, the upper block hooking to its pendant at the topmast-head.

The main yard should be braced *up*,* and, if both purchases are used, the fore yard braced *in*, sufficiently to clear the fore rigging, and to render the force of the purchase nearly vertical; and the yards topped up on the side used, before the strain on the lifts and burtons is equalized.

The weight of the article purchased is, in a great measure, communicated from the yard to the mast head, while the force of the yard inward acts upon the lee lift, truss and slings, which must be relieved by hauling well taut the opposite lift; also hook a burton or stout luff to the opposite yard, and its double block to a selvagee around the mast in the wake of the truss (fall leading on deck), which burton must be hauled well taut. This is similar to a rolling tackle and takes that name.

When any very heavy weight is to be supported by a yard working on a patent truss, it is advisable to get a fore-and-aft tackle on the slings of the yard, bowse it forward, unkey the navel bolt and let the yard swing in to the mast (the slings permitting), where it should be lashed, having first passed old canvas in the wake of the lashing.

The following are the different purchases used, viz.:—The yard-tackle, winding-pendant and tackle, top-pendant and tackle, quarter-tackle, stay-tackles, and mast-head pendant tackles.

The Yard-tackle is composed of a "long tackle" or fiddle-block, a single block, and the fall. The fiddle-block is strapped with a pendant, in the end of which is spliced a hook and thimble; the single block is also strapped with a hook and thimble. The pendant to the double block is either short, and intended to be hooked to a strap on the yard just within the burton strap; or, is fitted long enough to reach from the lower mast-head to the lower yard arms; lizards are fitted on these pendants. The pendant is hooked to the lower cap, and the lizard (having tails long enough to be secured with two round turns around the yard-arms), when secured, allows the fiddle-block to play a few feet below the yard.

The Top-pendant and Tackle are used in the following manner: Lash a large thimble or single block on the yard within

* How much it should be braced, or whether it should remain square, of course depends upon the peculiar circumstances of the case.

the sheave-hole, reeve the pointed end of the top-pendant *up* through this thimble (forward of the yard), then *down* through the top-block hooked to the lower cap, or a stout strap around the mast-head; then on deck. Having hooked to the thimble in the lower end of the pendant the upper block of the tackle, haul down ("round-down") on the lower end until the double block is the requisite height, when the end of the pendant must be well secured on deck.

When both the top and winding purchases are used, the pendant of the former may be secured around the topmast head, setting well up the opposite back-stays. These purchases, varying so little in their construction, should be each of sufficient strength to hoist in or out the launch, so that but one purchase on the yard may be used. They and the quarter-tackle are used to raise the articles, while the stay-tackles serve to guy them inboard, and lower them to their respective places.

The Triatic-stay consists of three parts—two pendants, and span. The pendants with hooks in their upper ends, which hook to bolts in the lower caps (fore and main), or are secured around the mast-head. In the lower ends of these pendants are spliced thimbles, into which the stay-tackles hook. These pendants are spanned together by another rope, the ends of which span are spliced around thimbles which traverse on the pendants. The length of the span will be the distance you wish to have your pendants apart, viz., the length of the launch.

Vessels stowing two tiers of boats should always be supplied with two triatic-stays, so as to hoist in the boats on their respective sides. On board the steam frigates, the triatic-stay leads from the topmast-head.

Mast-head Pendant-tackles are used to hoist any heavy articles out of the fore or main hold; to transport or fish anchors; or in any case when the purchase is required immediately over the deck. They are also used in place of stay-tackles to get the boats in when the vessel is not supplied with a triatic-stay. They do not answer as well for the latter purpose, as they act too obliquely, and are seldom thus used.

In hoisting in lighter articles, as water-casks, with the main yard, a quarter-tackle and a single whip only on the main stay are used. The fall of the yard-tackle leads through a snatch-block hooked to an eye-bolt in the deck by the mainmast on the same side; and the fall of the whip leads over on the opposite side of the deck. While hoisting on the yard-tackle, a few hands take in the slack of the whip. When the cask is sufficiently high to clear the hammocks, a turn is taken with the whip, and the fall of the yard-tackle is eased over a pin or cleat abaft, until

the cask is over the hatch or gangway, when the tackle and whip are lowered together, and the cask landed on swabs, or a mat made for the purpose.

In port, when it is desirable to keep the quarter-deck clear and clean, the snatch-block for the yard-tackle fall may be hooked abreast of the forward coamings of the main hatch, the fall leading forward.

When using the "yard and stay," to provision or water ship, it will be found very advantageous to use a small single whip, or tricing-line, to light over the lower block of the tackle, to the great saving of paint work; and coamings of hatches should be carefully protected from injury by heavy mats or boards. This is very essential.

Hoisting in a Launch and other Boats. In stationing the crew of a vessel-of-war, certain men should be detailed for the different stations in hoisting in boats, viz.: on the yards, tops, &c. When all hands are called to "*in*" or "*out boats*," these men are to be ready at the ladders to go aloft when ordered, while a portion of the fore and main-topmen are stationed to clear away the booms for the reception of the boats, or in clearing away the boats to be hoisted out. Some of the boats' crew are stationed in the boats to pass out the oars, masts, sails, &c., to haul them alongside, and be in readiness to hook the purchases.

The following distribution of duty has been general throughout the service:

Forecastle-men take out their own whip on fore-yard (generally the second captain takes out the fore clew-jigger), are responsible for the fore-yard tackle, and hook the burton on the fore-yard.

Fore-topmen overhaul down their burton, sending the fall on deck; send down whip for fore-triatic, and look out for fore-stay tackle.

Quarter-gunners look out for main-yard tackle, getting whip (main clew-jigger) on main-lift, &c., &c.

Main-topmen send down whip for triatic-stay, overhaul down burton, and look out for main-stay tackle.

Mast-men are responsible for leading-blocks.

NOTE. When the main-yard and stay-tackles alone are used, as in provisioning ship, the fore-topmen break out, make up, and stow away the former, and the main-topmen the latter.

The men being reported up, the officer of the deck gives the order, *Lay aloft!* when the men detailed will proceed to their

stations. The men on the yard will receive the burtons* and whips from the tops; when ready, give the order, *Lay out!* The yard-men will lay out together; secure the tail-block of whip to the lift above the burton-strap; hook the burtons; and be in readiness to secure the purchase, when swayed up to them. The men in the tops send the falls of the burtons and the hauling part of the whip down on deck, send down from the forward part of the main and after part of the fore-top, the whips for the triatic-stay pendants, which whips are bent on deck to their respective tackles and pendants; and the double blocks of the stay-tackles hooked to the thimbles in the pendants and the hooks moused. The fore and main-braces, and the whips, being manned, give the order, *Trice up, brace in!* At which the main-yard is braced *up*, the fore-yard *in*, the purchases are whipped up to the yards, and the ends of the triatic-pendants to the tops. The yards are then secured,† and the purchases hooked and moused, as directed in the foregoing paragraphs. While this is going on, the launch is hauled up alongside, oars, masts, thwarts, sails, &c., are passed out of her, and the booms prepared for her reception. The lower blocks of the yard and stay-tackles are hooked to the rings in her stem and stern posts, and the hooks moused.

In hoisting in a boat, particularly an old one, it is advisable to be prepared for the ring-bolts, in the stem and stern, drawing. To do so, have two spans. The after one hooked to an eye-bolt that is riveted through the keel nearly under the after thwart, and to the ring-bolt through the stern-post. The forward span hooks to an eye-bolt riveted through the keel forward, and to the ring-bolt through the stem. The purchases are hooked to thimbles in the bight of each span. (Chain spans or slings are preferable. See BOATS.)

The falls of the purchases lead thus: That of the *main*-yard purchase, through a snatch-block hooked in an eye-bolt in the deck by the main-fiferail, and then aft. The *fore* leads through one hooked by the fore-fiferail, leading aft. The *fore-stay* through one hooked by the fore-fiferail, and the *main* through one by the main; both the latter on the opposite side of the deck, leading aft.

Everything being in readiness, give the order, *Man the yards!*‡ At which the men lay in from the yards to the top. The yard purchases are manned, and a sufficient number of men at the stay purchases to take in the slack as the boat is purchased;

* Top-burtons are always kept hooked to their pendants, ready for use.

† The men on the yards look out for and report when the lift and burton are taut alike.

‡ *i. e.*, Man the *falls* of the *yard-tackles*.

one man in the bows and another in the stern of the boat. Now give the order, *Walk away with the yards!* When the boat is sufficiently high, order, *Turn with the yards! Man the stays!* At this, a turn is taken, with the yards, two men remaining by each to ease off as the boat comes in, while the remainder of the men man the stays. *Walk away with the stays!* As the boat comes in, the yard-tackles are eased off, until she is over the boat chocks; then, *Well the stays! Lower away of all!* Both the yard and stay-tackles are lowered, and she is landed on the chocks, the men in the boats overhauling the purchases; the carpenter and his mates being ready, as she is lowered, to place her properly.

It may be necessary to use the ordinary main stay-tackle, or mast-head pendant-tackle, as a fore-and-aft stay, to guy the boat clear of the fore-rigging and back-stays of a sailing vessel, or the smoke-stack of a steam-frigate.

Hoist in the smaller boats in the same manner, using the yard and stay-tackles.

If the boats have any water in them, it is well, when a little way up, to "*avast hoisting*," and let it run out, or wash out any sand or dirt that may be in them, though a heavy boat should not remain long on the purchases.

After the boats are in or out, give the order, *Lay out!* The men lay out on the lower yards, cast off the lizards, unhook the burtons, &c.; the topmen cast off the end of the stay-pendant—hands being stationed by the whips and the braces manned; give the cautionary order, *Stand by to lower away together!* then order, *Haul taut, Square away!* At this, the purchases are lowered on deck, the yards squared, the whips taken off the lifts; the men on deck make up the purchases to be stowed away, and having given the topmen sufficient time to stow away their gear, give the order, *Lay down from aloft!* when all the men are to leave the tops.

Hoisting in a Launch at Sea, by the Wind. Having the purchases and triatic-stay ready, brace aback the main-yard and secure it, as before directed, by hauling taut the lifts, with burtons on the lee yard-arm; hook the weather rolling-tackle. Having your yard well secured, send up the purchases, yard, and stay-tackles, overhaul down and hook them into the boat, and hoist it up to leeward, as before directed. Then fill away and send down the purchases.

Hoisting in a Launch and First Cutter together, at anchor. This may be necessary if in great haste to leave the harbor, all the boats being out. The fore and main-yards must be kept

square by the lifts and braces, and means used to rouse the boats, when weighed, clear of the fore-rigging, and to divide the purchases properly; both the yards must be properly secured as before directed, and have burtons on the side that the launch is to be purchased, to assist the lifts.

Send up the purchases on both sides, using the heaviest purchases for the launch. If you have two triatic-stays, use them on both sides; if only one, use it for the launch; and use the fore-topsail halliards and main pendant-tackle, to supply the place of the triatic-stay and tackle, for the first cutter. Hook also the main pendant-tackle to the stern of the launch.

Weigh them as before, and rouse them clear of the fore-rigging by the main pendant-tackles. Land the launch on the chocks, and the first cutter in the gangway until the launch is placed, then weigh the first cutter with the stay-tackles and place it in the launch—unless, as in large vessels, the boats are stowed in two tiers, in which case you place the first cutter at once.

To Hoist in Boats at Sea, having the Wind aft. In the event of chasing, or being chased by an enemy, the boats all out towing ship, a breeze should spring up, and wishing to lose no time by heaving to, they may be gotten in, in the following manner: Having the boats well secured by towlines, put the vessel before the wind, and make sail. Secure the yards as before directed. Haul up the launch on the port side, get a stout hawser from the port quarter, and secure it to the stern of the launch; secure it also inboard. Get the purchases up, hook and mouse them, and proceed to hoist her in as before directed. The only difficulty is, that with headway on the vessel, the moment the boat is freed from the resistance she meets with in moving through the water, she will surge forward with a violence in proportion to the velocity of the vessel, and not only endanger the yard and purchases, but also the rings to which the purchases are hooked. The hawser from the quarter to the stern of the boat prevents this, and renders the operation, as soon as the boat leaves the water, as simple as under ordinary circumstances.

This evolution was performed by the Constitution during the memorable and exciting chase, in which she escaped from the British squadron, in July, 1812.

It is not uncommon to see boats taken in with the yards very inadequately secured, and sometimes with half-worn water-whips, simply because they happen to be handy, whereas the preparations for getting in a gun would be quite elaborate. A very simple calculation will show that a boat may be fully equal to straining an unsupported yard injuriously, thus:

PURCHASING GUNS.

To find the weight of Boats in pounds, multiply the square of the breadth by the length and that product for a launch by 2.5; first cutter by 1.9; second cutter by 1.4; quarter boat by 1.0, to which may often be added an allowance for the men in her, the oars, etc., sand, water, her being water-soaked, etc., etc.

It would be well when hoisting in a heavy boat to use a preventer fore-brace leading from the bowsprit end.

On board our modern ships the distance between the fore and main masts is so great, that the fore-yard tackle acts very obliquely. For this and other reasons, it would be a good plan to have derricks expressly fitted for getting the boom-boats in and out; purchasing the sheet anchors, guns and heavy weights generally, to the great saving of the yards. These derricks may be rigged temporarily of spare spars, after the manner of the old style of fish-davit, or, fitted like the modern fish-boom for the express purpose. Or again, they may be made of iron and used as davits for a waist-boat like those of our steam-sloops, but made strong enough to take up a first rate's waist-anchor.

Indeed one davit or derrick and the main-yard might be used for getting in boats, a plan that would enable them to be taken in on both sides at once; an operation which could hardly be practised on board a steam-frigate by the ordinary means on account of the distance between the masts and having to keep the yards square.

Getting in Guns on Covered Decks, Fig. 365, Plate 62. After bracing the yard over the port through which it is intended to take the guns, secure the lizard of the pendant round the yard, five or six feet outside of the ship, and hook the top burtons just outside of the lizard. The lizard should be far enough out to clear the ship's side.

Haul taut, and bring an equal strain on the burtons and lifts. Hook a rolling tackle on the opposite side of the yard, bowse it well taut and the trusses also if they are of rope. Pass the end of the pendant of the gun-purchase through the thimble of the lizard; take the end up and make it fast round the top-mast just above the lower cap. To the eye of the pendant, which should hang a few feet below the yard, is hooked one block of a double purchase; overhaul down the lower double block with the fall part leading from it *up* through a single block lashed securely on the quarter of the yard, directly over the gangway; then through a block at the mast-head and *down* through a leading block on deck.

The advantage of this lead is, it acts both as purchase and guy.

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Have the port lined with pine boards, to keep it from being chafed.

Bore a hole in the deck or decks through which it is intended to pass the gurnet, as nearly as possible over the rear end of the gun-carriage, and as near in a line with the centre of the port into which the guns are to come as the beams will allow. Pass the upper end of the gurnet through the hole, and turn in the thimble, to which, hook the pendant tackle. Place a tackle across the deck, ready for bowsing the gun into its carriage through the port.

Bring the gun under the yard and sling it as follows: place one bight of the slings over the cascable, and pass the lashing, which is attached to the slings, round the chase, at such a distance from the trunnions as will allow them to go into the trunnion-holes, without bringing too great a pressure of the slings against the upper port-sill. Then toggle or hook the gun-purchase to the outer bight of the slings and sway away. When the breech of the gun is above the port-sill, hook the gurnet and the thwart-ship tackle to the cascable, and bowse on both. When the slings bear hard on the upper port-sill, lower the gun-purchase, and bowse on the gurnet, until the breech is high enough for the trunnions to clear the cap-square bolts in the carriage; then bowse on the thwart-ship tackle until the trunnions are over the trunnion-holes, lowering the purchase as required to bring the gun into its place.

As each gun is mounted, unhook the purchase and gurnet, take off the slings, run the carriage to its proper port, and place another for the next gun.

Taking in Guns over all. Sling the gun slightly breech heavy, to render it more manageable. If it is to be mounted on the spar deck, place the carriage in the gangway: if on the main deck, close to the main hatchway on that deck. In place of the gurnet hook the stay-purchase for lowering the gun into its carriage.

Getting out Guns through Ports. Secure the yard as in getting in guns, and sling the gun in the same manner. Hook the gurnet, and haul it well taut, so as to raise the breech of the gun as much as the port-sill will permit; hook or toggle the gun-purchase, and sway away. As soon as the trunnions are clear of the carriage, haul it from under the gun, ease away the gurnet, and let the gun go out the port. As soon as the gun is perpendicular to the purchase, unhook the gurnet and lower the gun into the lighter, or on the wharf, as the case may be.

If the gun is to be taken out *over all*, the stay tackle is to be substituted for the gurnet, only it is to hooked to the same end

of the slings as the gun-purchase, and the lashing on the slings is to be passed around the chase of the gun, as near the trunnions as possible.

Throwing Guns overboard. The gun's crew being assembled at quarters, remove the pin and chock from the cascable, into the jaws of which place a selvagee strap; hook the double block of the train tackle into the housing bolt over the port, and its single block into the selvagee strap; remove the cap squares, and place a round block of wood on the sill of the port high enough to let the chase bear on it when slightly depressed; raise the breech as much as possible without lifting the gun out of the carriage. When all is ready, man the train-tackle well; have the handspike-men also ready to resist in raising the breech; and if the vessel is not rolling, it will be well to have additional handspikes under the rear of the carriage to lift it also, so as to give free egress to the gun. When all is ready, give the order: "All together—launch." In a gale of wind, advantage should be taken of a favorable roll to give the word, that the action of the sea and of the men at the guns may be simultaneous.

If the guns are to be thrown overboard* for the purpose of lightening a ship which is aground, they must be buoyed, and care is to be taken that each buoy-rope is of a proper length, and strong enough to weigh the gun. The best mode of securing the buoy-rope to the gun is to form a clinch or splice an eye in the end which goes over the cascable, and take a half-hitch with the bight around the chase of the gun, and stop it with spun-yarn.

The buoy must have sufficient buoyancy to float the rope when saturated; or in deep water, a smaller line may be used for the buoy, and attached to the rope intended for weighing the gun, that it may be hauled up when wanted.

Other Methods for getting in Guns. For taking in or hoisting out main-deck guns, no purchase that can be rigged is so quick, safe, and convenient, as the davit, excepting the cat.

But the cat-head is only available when it overlooks a port; the davit may be rigged anywhere, as is evident in the case of the waist anchors.

Whichever of these two methods be adopted, it must be observed that the longer the slings are, the less will the lower purchase block nip against the upper port-sill. If the cat-block be used, the hook should stand outward, and whatever kind of purchase be used in working guns through ports, the port should be lined, and the port-lid unshipped.

* In such an event the guns must be rafted well clear of the ship, lest she bilge on them.

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For main-deck guns, a hole is cut through the plank of the deck overhead in a line with the centre of the port, and something more than the length of the gun carriage from the side; through this the eye of the strap of a clump-block is rove, which is toggled on the deck above, and wedged nearly close up.

The runner of a tackle is rove through a block on the other side of the deck, looking straight into the clump, led through the clump and *clinched* into a good hook; this is also called a *gurnet*.

The gun is slung on its upper side by a pair of rope or chain slings, one bight of which goes over the neck, both parts being seized together, leaving an eye large enough to be easily thus placed; the other end is hauled taut along the gun, and a lashing is passed round slings and gun outside the trunnions; to this end the purchase hooks. The gun is hoisted muzzle upward, the gurnet pulled up, the purchase let go, and if *nicely* lashed at the right spot, the trunnions fall right into the holes; the cap squares are turned over, and the forelocks put in.

To Rig a Yard Purchase—say, starboard side. Brace the main-yard so as to overlook a convenient port; line that port; unship the port lid, and then measure for the gurnet hole. Top the yard, hook the port rolling tackle, to a strap on the mast at the futtock-band, reeving the fall there, and sending it on deck. Put a burton on the starboard yard-arm from the cap, hooking it to a strap on the yard far enough out to plumb a lighter's hatchway. In small ships put a cross lashing on the slings of the yard round the mast, first unbolting the truss, and haul taut all the gear. Reeve a set of top tackle gear on the deck, running the top block down the pendant close to the upper top tackle block, and rack it there. If the yard is forward, send the starboard main-top-sail buntline down abaft the main yard, and a double whip from the main lift. Trice the top block up with the whip, and the pendant with the buntline. Secure the pendant over the main cap, putting some mats between them. Lash the top block round the main-yard near the burton strap and cut the racking. Put a whip on the lower block from the off side of the lighter to round the purchase down with, and work its fall on the deck of the ship. Hook the starboard pendant tackle for the gurnet. If the top tackle fall is short, let down the pendant; and if the yard is small and the weight to be raised great, tail the fall and carry it through a leading block at the upper top block to the mast-head, and thence to the deck, or shift the blocks so that the fall may lead from the lower block.

Another way to rig the gun-purchase is to arrange everything as before described, but omitting to lash the top block, and put-

PLATE 63

Fig. 366

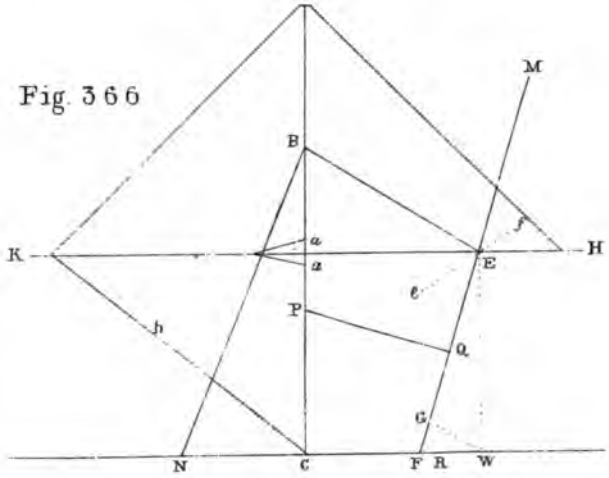
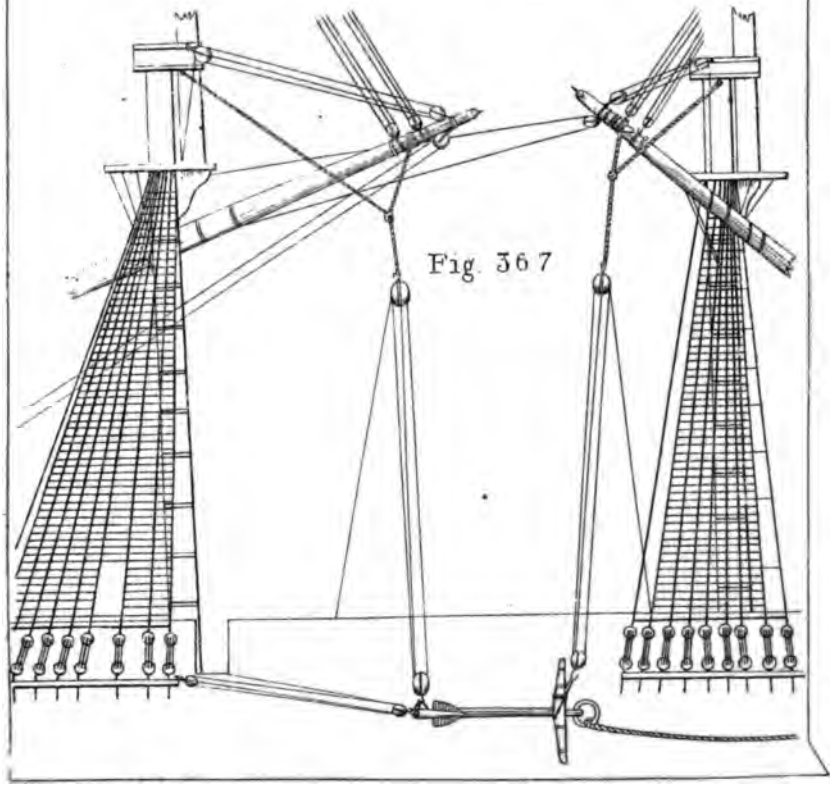


Fig. 367



ting a runner and tackle on the yard for an out-hauler; then lash the runner block at the yard-arm; pass the runner over the main cap, rounding the tackle close up, and securing the runner round the mast-head; make the lower block of the tackle fast to the top block; haul out on the tackle until the purchase plumbs the hold of the lighter; when the gun is up, ease in the tackle, and so on.

In hoisting guns out with this purchase, the purchase is eased in far enough to plumb the port; and when the gun is weighed, the runner tackle is hauled far enough out to admit of lowering it into the vessel alongside.

In most cases where this kind of purchase is made use of, there is more strain on the running tackle than is quite safe; especially when the lighter is not an open one, and the purchase has to plumb her hatchway.

To get in a XV-inch Gun. Fig. 366, Plate 63. Lower the main-yard to a distance of forty feet from the deck, clap a couple of stout anchor-straps on the lee quarter, cleat them up, and pass trustworthy lashings, *a*, *a*, through the bights of the strap and round the mast; overhaul the lee quarter tackle, *b*, and hook it to a bolt in the partners. Hang the yard by pendant tackles from the lower pendants, pass a cross-lashing round yard and mast, and unreeve the jeers.

Derrick. Get the spare main-topmast up, droop it to the proper angle, wedge the heel up and secure it, shore the decks up, and lash the derrick with a cross lashing to the after side of the main-yard,—the lashing passed in the direction *e f*.

Topping-Lift. Fish-fall, rove from opposite side of the deck, through the fish-davit head block* at the mast-head.

Derrick-head Guys. Main runners and tackles—forward and aft; runners hitched round derrick-head and yard.

Shore, P. Q.—Mizzen Gaff. The jaws lashed upon the derrick, and the peak to the mast with a cross-lashing and turns through the peak-halliard bolts.

Belly-Guys. Forward and aft. Pendant tackles with luffs on their falls; two to be hooked forward, the outside one to be dipped outside the derrick purchase as the stay purchase is hauled on, and the midship one to come up when the other is taut.

Derrick-head Purchase. Blocks, treble and four-fold 30-inch purchase blocks. Fall, 9-inch hawser.

* This refers to the old-fashioned fish-davit. Any large block lashed at the mast-head will answer.

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Mast-head Purchase. Reeve two top-tackle pendants through the top-blocks, pass the ends up through the hole for the slings on the fore part of the top, and secure them round the eyes of the rigging. Haul the top-block out to the derrick-head by a fish-fall, rove full; the hauling part being led through a block at the mast-head. Reeve a cat-fall through two cat-blocks for the purchase, trice it up and hook it to the pendants.

The main yard is used to prevent the derrick coming in when the stay-purchase is hauled upon; and it also acts as a cross-piece to the top-mast, to prevent the purchase slipping down. It consequently hangs freely, being supported at the yard-arm by the topping-lift; and the trifling strain brought upon it, being horizontal, is thrown upon the quarter and cross-lashings round the mainmast.

To ascertain the strain the gear will have to bear, lay off B C equal to the length of the mast from deck to tressle-trees, minus the drop of the topping-lift block, which will be about 63 feet. Project the main yard, K H, at the calculated height from the deck, = 40 feet. Raise the derrick, F M, at the necessary angle, and position upon the deck, N R. Connect E B N, to represent the topping-lift; and let fall E W, to represent the purchase with the weight attached.

On the line E W lay off E W = 40 tons (weight + resistance in lifting, or 30 + one third), and draw W G parallel to B E. Then G E will represent the pressure on the derrick in the direction of its length, and G W the tension on the topping-lift E B. Measure G E and G W; and it will be found that the derrick will have to support a strain of 35 tons, and the topping-lift a strain of 12 tons.

To find, now, what the purchases, topping-lift, and derrick, are capable of bearing:—

Derrick-head Purchase. Seven parts of 9-inch hawser, minus the allowance for friction, by rule previously given (Chapter on Rope), are capable of *lifting* 73.5 tons.

Mast-head Purchase. Two pendants of 9-inch rope = 39 tons. Fall, six parts of 6-inch = 39 tons.

Topping-Lift. Five parts of 5-inch = 23 tons.

To ascertain the strength of the derrick:—*

* *To find the weight which a column of given material will support before flexure.*—Multiply the tabular number in col. E by .121 times the fourth power of the diameter in inches in cylindric columns, or .2056 times the side in inches, in square

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Least diameter of topmast, 20 inches	1.301030
	4
	5.204120
121	9.082785
	4.286905
Tab. No. Norway spars, 5830000	6.765669
	1.052574
EQ, 22 ft.=252 in. Squared	4.802802
	lbs. 6.249772
112 lbs. in cwt	2.049218
	cwt. 4.200554
20 cwt. in ton	1.301030
4)793	tons 2.899524

198 tons = practical strength of derrick.

The whole length of the derrick, EF, is 42 feet; but as it is securely held amidships by the shore and belly-guys, the distance between the supports is that alone affected by the strain. Without the shore and belly-guys, the derrick, by calculation, would only support a weight of 50 tons. And as strength varies inversely with the square of the length, $21^2 : 42^2 :: x : 198$. By this, also, $x = 50$ tons nearly.

Thrown into a tabular form, it will be seen that there are means for lifting any possible weight with ease and safety.

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prismatic columns, and divide the product by the square of the length in inches, the quotient is the weight required in lbs. *Note.*—When the base of the column is rectangular, multiply the tabular number by .2056 times the area multiplied by the square of its breadth, and divide as before. Only $\frac{1}{3}$ or $\frac{1}{4}$ of this weight ought to be depended upon in practice; for when once the column begins to bend, the consequences are inevitable. Thus, the weight under which a pillar of New England fir would begin to bend, supposing its length 20 feet and its diameter 12 inches, is $(5967000 \times .121 \times 12 \times 12 \times 12 \times 12) \div (20 \times 20 \times 12 \times 12) = 259922.52$lbs., or nearly 116 tons, a most enormous load, according to theory; but 20 tons could only be trusted in practice.

This rule is taken from a table in the "Mechanic's Pocket Guide." The example is given simply to show how easy it is to adapt, by calculation, the purchases to the work in hand, and it is always better to base one's operations on estimates of this kind than trust altogether to *guessing*.

PURCHASING ANCHORS.

GEAR.	Capacity for strain: calculated at the minimum strength of materials.	Strain produced.
Derrick-head purchase.....	Fall.....73 tons (Blocks.....84 ")	40 tons.
Mast-head purchase.....	39 "	
Topping-lift.....	23 "	12 tons.
Derrick.....	198 "	36 tons.

To bring the gun in over the main-hatchway, rig a stay derrick of the spare fore-topmast, and support it by a topping lift, belly guys, and a shore to the mainmast.

Purchase. Blocks, upper fore and main jeer blocks, 26-inch and 24-inch treble. Fall fore and main jeers, 8-inch and 7½ inch spliced together.

Topping-lift. A cat-fall rove through top-tackle blocks.

Mast-head Purchase used for hoisting is eased in, and becomes a stay purchase.

PURCHASING ANCHORS.

The bower anchors are got up to the bows by means of the cat and fish purchases, and are secured in their places at the cat-head by the cat-head stoppers and shank-painters. The sheet and spare anchors are purchased in the following manner:

Having secured the lower yards well, and topped them up on the side used, brace *in* the fore, and *forward* the main yard.

Send up the purchases. The yard, winding, or top-pendant and tackle may be used, having the strap on the yard, or regulating the lizard, so that the purchase may be far enough out to take the anchor clear of the side, Fig. 367.

Having the anchor alongside with the crown aft, pass a long strap around the shank, near the stock, to which it must be lashed about one third the distance up, for the purpose of keeping the stock perpendicular when the anchor is raised. Hook or toggle the fore purchase to this strap above the lashing, and hook the main purchase to another strap around the crown of the anchor.

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The fore-topsail halliards may also be used to assist the top-tackle; it will relieve the lower yards, and serve to rouse the anchor into its place in the waist; but bear this always in mind, that whenever you use the topsail halliards as a purchase, except to perform its own peculiar office, the tye should be racked aloft, to the topmast backstay.

Having swayed the anchor up, rouse it in with thwartship-jiggers, place the bills in shoes, or its arm upon the gunwale, place the shores, trip-stoppers, &c., and pass the stop and shank lashings.

For purchasing a Sheet Anchor to get it in its proper place in the waist. The following is a description of a plan found very successful:—

The fore-yard, being braced up sufficiently on the side used, was topped up; trusses set taut, rolling tackles hooked, and hauled taut; both burtons from topmast head overhauled down, and hooked to straps on the yard; and a pendant tackle, hooked to the lower cap, was also hooked to a strap on the yard; all the burtons, pendant tackle, and lift hauled taut alike. The opposite topmast breast back-stays were well set up. A stout single block was lashed to the yard-arm with a long lashing, through which the pointed end of the top-pendant was rove *up*, and the end hitched around the topmast above the lower cap. To the thimble in the lower end of the top-pendant was hooked the upper block of a threefold purchase; another small purchase was lashed to the yard about three feet farther in.

The top-pendant purchase was hooked to a strap around the shank near the stock, while the smaller purchase was lashed to the stock, to assist in raising while it kept the stock perpendicular.

The main yard, being braced up and secured as the fore, the main purchase was hooked to a stout lashing on the crown of the anchor. A hawser was bent to the ring of the anchor, and the other purchases made use of to guy the anchor forward and aft as might be required.

Transporting Anchors. The anchor intended to be stowed in the main-hatch is gotten in by means as directed in the previous paragraphs. In addition to the purchases there spoken of, the mast-head pendant tackle is used, hooked to a stout lashing around the crown of the anchor, and also one from forward, to keep it clear of the mast, and coamings of the hatch in lowering.

PURCHASING ANCHORS.

In any case where it is required to transport this anchor from its place to the bows, to supply the place of a lost one, it may be done by the mast-head pendant-tackles; thus, the lashings being cast off, the main pendant-tackle is hooked to a stout strap arou d the crown of the anchor; and a tackle, leading forward on the lower deck, is hooked to the shank of the anchor, to guy it clear as it goes up. Sway up, and as the crown comes above the upper deck, the pendant-tackle from the foremast head is hooked to a strap on the shank, two thirds the distance from the crown to the stock, or on the small round within the square part. The berth-deck tackle being unhooked, it is thus transported forward as far as the foremast.

The fore-yard is previously braced up, and well secured, so that the purchases may hang clear of the cat-head. The fore-yard purchase is now hooked to a strap around the shank, near the stock, by which the anchor is transported forward of the mast. Here it is lowered on the deck, the lower bill resting on a shoe, and the shank placed properly on the stock, which is on deck in readiness to receive it.

While the armorers are fitting and securing the stock, the main pendant-tackle is unhooked, being of no further use; the fore pendant-tackle is unhooked from the pendant abaft, and hooked to the one forward.

The anchor now being stocked, and the purchases manned, transport it over the bows by means of the purchase on the fore-yard and fore pendant-tackle. When high enough and clear of the side, lower away to the water's edge, hook the cat to the ring, and rouse it up to the cat-head; send down the purchases and square the yard; bend the cable, fish the anchor, and get it ready for letting go.

To Transport an Anchor from the Waist to the Bows. Having the cable bent, and well bitted, get the anchor ready for letting go; pass the messenger, bring to on the cable, ship the capstan bars, and call, *All hands up anchor!* when ready, let go the anchor, and then heave it up to the bows, and purchase it by the cat, and fish.

It may also be transported by the yard purchases, in case it may not be advisable to proceed by the foregoing plan, thus:— Have the fore and main yards well secured with burtons from the topmast and lower mast-heads, and with rolling-tackles; brace the main-yard *up* sharp, and the fore yard *in* a little; top them well up, particularly the fore-yard; send up the yard and winding-tackles. Hook the fore-yard tackle to a stout lashing around the shank just within the stock, the winding-tackle to the ring of

PURCHASING ANCHORS.

the anchor, and the fore-topsails halliards to the upper stock. Hook the main purchase to a lashing around the crown and both arms. Walk away with the yard-purchases, keeping a strain upon the topsail halliards to steady the anchor and keep the stock perpendicular. When the anchor is clear of the ship's side, ease away on the main-yard and stay-purchases, hauling on those of the fore-yard, until the anchor hangs by the latter. Then man the fore-brace and brace the yard up handsomely, until the anchor is plumb with the cat-head; lower away, hook the cat and rouse it up to the cat-head. Unhook all the purchases and send them down.

You may hook the cat and fish as soon as the anchor is clear of the ship's side, and it may be advisable to do so, as the latter, particularly, will be serviceable in transporting it to the bows.

The fore-yard should not be braced in so far that the burtons and lift will take against the rigging, for in bracing them up again they would not bear an equal strain.

By this plan, you may transport anchors from the bows to the waist.

There is always more or less risk attending the bracing of a yard with such a weight as a sheet-anchor hanging on it, therefore it should not be attempted unless unavoidable; for as soon as the position of the yard is changed by the braces, the supports radiating from different centres and describing different arcs, must be variously affected, so that they may be broken in detail, and the yard sprung or carried away. When circumstances will permit, a very good way to get an anchor forward or aft is to hoist it inboard, and transport it on a transporting truck, then secure the yards and get it in its place.

Should the former plan be adopted, of bracing around the fore-yard, good hands should be stationed to attend the burtons, and at the first indication of the slacking up of any one, to haul it taut again, and for that purpose jiggers clapped on the fall would be a material assistance.

Waist anchors have frequently been transported without touching the fore-brace—thus, having the yards secured as before, with the fore-yard braced in a very little, pull up on the tackles, easing away the lashings handsomely until the anchor hangs fair in the purchases. Now "walk away with the fore" and ease roundly the main-yard, till the anchor hangs plumb under the former, when hook the cat, having previously overhauled it to the fore-chains. Unhook the main yard-tackle and man the cat-fall; when ready "walk away with the cat" and "ease away the fore-yard," walking the anchor up to the cat-head.

PURCHASING ANCHORS.

In a similar manner the anchor may be transported from the cat-head to the waist.

If the construction of the ship admits, as it did in most of the sailing ships, the latter plan is recommended.

To Re-stow a Sheet Anchor with the Fish-Davits. Rig two fish-davits, similar to the old-fashioned fish-davit of a frigate, the foremost one close before the place where the ring of the sheet-anchor stows, using a cat-block instead of the lower fish-block, as it will allow an extra part to be rove with the fish-fall.

Step the other abreast of the place where the balancing point on the shank will come. Rig this after-davit with a top-block, lashing it in the room of the fish-block and leading block. Reeve the pointed end of the top-tackle pendant down through the top block, hauling the thimble close to the block; then through a second top-block and secure the bight of the pendant round the davit end, leaving the lower top-block hanging three or four fathoms down. Reeve and hook the top-tackle to the thimble in the pendant and a bolt on the opposite side of the deck.

The topping lifts of both davits must be hooked across the deck.

Get up the fore-yard tackle, and pass the lower block forward to take the weight of the chain.

Pull the anchor up to the cat-head as usual.

Hook on the foremost fish-tackle to the ring of the anchor, and the fore-yard tackle to the chain in the hawse-hole; haul taut; ease down the cat till the ring is awash, then pull up the fish, ease up the cat, pulling the anchor well up.

Lash the top block to the balancing point on the shank, first taking two round turns with the lashing round the shank to prevent its slipping; hook two luffs to straps, one on each arm of the stock; man the top-tackle fall and pull the anchor up high enough for placing.

Top the davit up, placing the anchor with a burton from forward or aft as requisite, and the luffs on the stock, which insure its balancing.

The cable must be triced up in the fore chains if it makes the foremost end too heavy.

In long-bowed ships or in sloops where the sheet-anchor is stowed well aft, the drift between the cat-head and the foremost fish-davit would be too great.

In this case, secure a top-pendant to the fore-topmast head close to the rigging, hook the top-tackle to the pendant, which is

PURCHASING ANCHORS.

hauled out as requisite to clear the ship's side by the yard-tackle.

Secure the yard with a burton, and if requisite brace it in, take the weight of the anchor with the top-tackle and proceed as before.

A burton on the fore-yard will take the weight of the cable instead of the yard-tackles, which is required to haul the pendant out.

To Re-stow a Sheet Anchor using a Boat. Rig the after fish-davit as before, but the foremost one is rigged in its proper place as usual, cat the anchor, hook the fish to a strap on the fluke, pull up, then lower the anchor into the boat with the flukes athwartships, hang the cable with the yard-tackle, haul astern, lash the top block as before to the balancing point on the shank, pull up and stow.

If the drift across the deck is not sufficient to take the anchor high enough, the pendant may be led through another top block and worked fore-and-aft, or a tackle may be rove from the fish-davit head.

When transporting anchors, the cable should be unbent, and a hawser, stout enough to weigh the anchor in the event of accident, bent in its stead.

CHAPTER XIV.

GROUND-TACKLE.

ANCHORS—CHAINS—THE CAPSTAN.

THE term *ground-tackle* comprises the anchors and cables of a ship and everything appertaining to them, such as *stoppers, nippers, messengers, hook-ropes, clear-hawse-pendants, deck-tackles, cat-falls, fish-davit, buoys, chain-hooks, compressors, etc.*

Anchors. Although the general form of the anchor has undergone but slight modification since the earliest ages, yet there are even at this late day as many opinions as authorities in regard to the best proportions and best shape of the various parts. There seems to be, however, a general concurrence in making the shank shorter and the several parts heavier than was common fifty years ago.

Anchors are of two kinds—*Solid*, or ordinary, and *Portable*.

The *Solid* or ordinary anchors are those which have the shank and arms wrought into one body, or mass, at the crown of the anchor. Fig. 368, Plate 64.

The *Portable* anchors are those which admit of being separated, or taken to pieces. Of this kind there are many varieties.

Porter's anchor, improved by Trotman, and known as Trotman's anchor, is generally conceded to be the best of the patent anchors. Fig. 369, Plate 65.

The anchor in common use in the navy, is composed of several parts, as follows:

The shank, Fig. 368, is all that part extending in a straight line, from *a* to *b*.

The square, is that part of the shank which extends from *b* to c, to which the *stock* and *shackle* are attached.

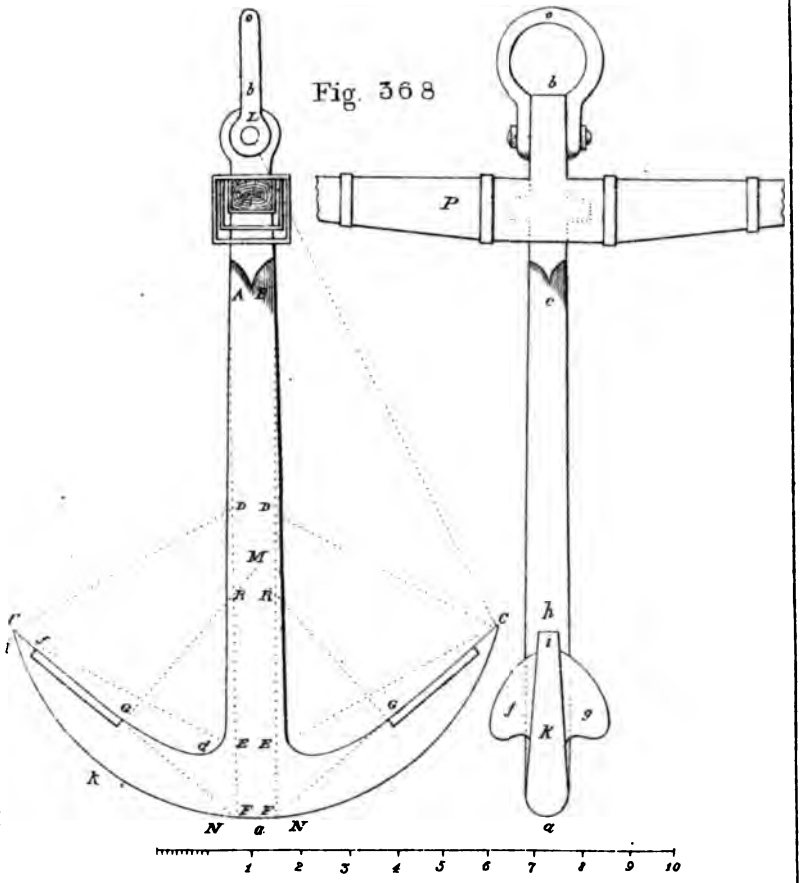
The arm is the part which extends from the *throat* (or *crutch*) to the extreme end, from *d* to c, including the *palm*, the *point* and the *blade*.

The palm or *fluke* is the part of the arm, of a shield-like form, from *f* to g, and constitutes the *holding* surface of the anchor.

The point (*pee* or *bill*) is the part of the arm included between the termination of the palm and the extreme end, from c to *f*.

PLATE 64

Fig. 368



ANCHORS.

The blade is the part of the arm at the back of the palm from *i* to *k*. This in some anchors is square or rectangular, in others it partakes of the same section as the arm.

The crown is the external arch upon which the anchor falls when let go in a vertical position, and may be said to extend from N to N.

The ring (or shackle), *o*, is the appendage by which the cable is attached to the anchor by means of a shackle on the end of the cable, called the anchor-shackle.

The stock, *p*, is the transverse beam which cants the anchor when the arms fall in a horizontal instead of a vertical position. The stock is either of wood or iron.

The *throat* of the arms is the curved part at *d* where the arms are joined to the shank; a distance equal to that between the throat of one arm and its bill is marked on the shank, from the place where it joins the arms and is called the *trend*.

Anchors are known under the denominations of "wood-stocked" and of "iron-stocked," and also as "bower," "sheet," "stream," and "kedge."

All anchors and chains used in the navy are made at the foundry in the navy-yard at Washington.

The hemp cables, hawsers, and towlines, are made in the rope-walk at the Boston navy-yard.

Rules for Finding Weight of Anchors and Kedges. The old rule for determining the weight of anchors for any vessel was as follows: For the bowers, two thirds the draught of water when loaded and the greatest breadth of beam, allowing one cwt. for each foot of the same.

Or the simple rule of five cwt. for every hundred tons burden, may be adopted.

These rules, adopted for the old models of sailing vessels, doubtless served very well in their day, but for the long and sharp steamers of the present time it is evident that anchors may be lightened without risk; for the fine lines and clean entrance of our modern ships, presenting but little opposition to the sea, cutting through them as it were, brings comparatively little strain upon the anchor and chain, particularly when riding to a long scope, now the common practice. Moreover, one can readily conceive of the effect produced upon one of our long, sharp steamers in a head sea, by a pair of heavy bowers. From what has been said, "Theory of Stowage," we may get an idea of the great momentum produced by their weight into the long leverage common to all our vessels. Hence there are two good rea-

ANCHORS.

sons why vessels tonning the same should have lighter ground tackle now than formerly.

The following is taken from Book of Allowances of 1865:

1st. *Bowers and Sheets* are to be all alike in weight. All anchors and kedges are to have iron stocks, except *bowers* weighing over 4,500 pounds, and they are to have wooden stocks, kept *thoroughly* well coated with coal-tar, *not paint*, to avoid the destructive effect of worms.

2d. It is to be understood that the weight of an anchor or kedge is exclusive of the stock, but inclusive of the bending-shackle. In our navy, the weight of an iron stock is, as nearly as may be, one fourth that of the anchor to which it pertains.

3d. *Stream anchors*, in all cases, when allowed, are to be about one fourth the weight of the bower.

4th. *Kedges*, when five are allowed, are to be, respectively, about one seventh, one eighth, one ninth, one tenth, and one fourteenth, the weight of the bower; when four are allowed, one seventh, one eighth, one tenth, and one fourteenth; when three are allowed, one sixth, one eighth, and one tenth; when two are allowed, one sixth and one tenth; and when one is allowed, one eighth.

5th. *To determine the weight of a bower or sheet anchor for a vessel of a given rate and character*, multiply the square of her extreme breadth by the number assigned to her rate and character in the following table, in the column headed "multipliers," and the product will express the number of pounds, exclusive of stock, but inclusive of bending-shackle. *This rule will give the intended weights, but, as anchors are not made to the pound, discretion will be exercised in furnishing them as nearly in accordance with it as practicable or necessary.*

ANCHORS AND KEDGES.

Rates.	Character of Vessel.	Multipliers.	Number allowed of—			
			Bowers.	Sheets.	Streams.	Kedges.
	Screw Steamers.					
1st.....	If a frigate, rigged as a ship or bark	3.0	2	2	1	4
2d.....	If a sloop, rigged as a ship or bark	3.0	2	2	1	4
2d.....	If a sloop rigged in a lighter way	2.5	2	2	1	4
3d.....	If a sloop or vessel between 900 and 1,200 tons, light rig	2.3	2	2	1	3
3d.....	If a sloop or vessel between 600 and 900 tons, light rig	2.3	2	1	1	2
4th.....	If a gunboat between 500 and 600 tons light rig.....	2.0	2	1	1	2
4th.....	If a gunboat less than 500 tons light rig	2.0	2	0	1	2

ANCHORS.

Designing Anchors. As there are numerous patterns of the common, as well as many patent anchors, a brief description of some of them will be given. In each the designer or patentee claims some decided improvement over the old pattern. To enable every one to judge for himself of their several merits, we will now describe the various strains, shocks, &c., to which anchors are subjected, and point out the forms that theory indicates as best to resist them. Preparatory to casting anchor, every obstruction is removed from around the chain, which is so arranged as to run freely out, and a man is placed near the cat-head. At the command of "*let go*," a trigger is pulled and the anchor falls vertically through the water on the ground (supposing it to have been cock-billed). On an even bottom the crown will strike first, but a hard rock may project, and one of the arms may strike it. To resist such a blow, the cross section of the arm has to be higher than it is wide, and similar sections ought to have decreasing heights from the crown to the bill. After striking the ground, the anchor falls sideways, the arms lie flat, and the stock rests on one end. A length of chain proportional to the depth of water, and so calculated that the hardest pull of the vessel will not lift it entirely from the ground, is permitted to run out, and is secured to the vessel. Soon after the action of the current or of the wind on the vessel makes her exert a traction on the chain, and this, lying on the ground, pulls down the shackle, bringing the stock flat on the bottom, and the arms perpendicular to it—this is called canting the anchor. The longer the stock, and the shorter the arms, the less force will be required to perform this operation; hence, in all anchors, the stock is longer than the arms. The effect on the stock is one of compression without lateral strain, the proper form of its section is that of a circle, and the stock has to be a bar of round iron, or a tube. After canting, the anchor will be dragged or will hold.

Quick holding depends on the sharpness of the bill and the angle of the palm with the ground. A sharp angle of the palm is also favorable to quick holding, and if this property alone was considered, it would be made much more acute than usual. After the bill holds on, the palm and arm enter the ground till, if the soil is not too hard, the shank lies on the bottom. In this new position, the angle of the palm with the horizon will be different from what it was when the anchor was just canted, and, for good holding, it has yet to be such as to give the blade a tendency to go deeper into the ground. For this reason, the angle cannot be made as sharp as would be most advantageous for quick holding. Practice has taught us to make it from seventy to eighty degrees when the anchor is canted on the floor. The angle of the palm

with the shank results from the one described, and from the relative lengths of arms and shank.

For weighing anchor, the chain or cable is taken in till the bow of the vessel is brought over the shackle; here, an increased pull is necessary to trip it, and the anchor is raised to its place. The property of quick tripping depends on the curve of the arm, and on the angle of the palm; they have to be such, that when the shackle is pulled up vertically, the bill cuts open a short curved circular way in which the palm and arm follow. When the palm is out, the ground is torn open by the arm, which is comparatively sharp, and acts with a more advantageous leverage than the palm would. No general principle can guide as to the shape of the arm, experiments alone have to be relied upon. The importance of this subject is evident from the fact that *more than two thirds* of the ruptures of anchors happen in the operation of weighing.

We have said that the arms ought to be thicker in the dimension parallel to the shank, to resist shocks against rocks. The same is necessary to resist the strain in tripping. The shank is exactly in the same circumstances, and has to be thicker in the direction of the arms, and to decrease in size from the crown to the square. Though theory indicates rectangular sections as best for the arms and shank, they are in practice made round, oval, or at least the angles are much rounded. This has been found necessary for the preservation of cables, which often take a turn around the anchor when the vessel changes its direction with the tide or wind.

In devising a new anchor, the danger of the ship grounding upon it in shallow water, and of a hole being made in her by projecting parts, is an important consideration to keep in sight.

The following proportions of parts is an average of those in use: Length of shank, 100; length of each arm, from the crown to the bill, 40; length of stock, 100; radius for describing the outside curve of the arms, 35; angle of the face of the palm with the shank, 51°. With such proportions the angle of the shank with the ground is 24°, and that of the blade, 75°.

Less than fifty years ago, anchors were tried by letting them fall from a height on old guns or heavy pieces of iron; the result of this process was, that many good anchors were broken, and many bad ones were considered safe; the manner of falling being necessarily left to chance, it was, in fact, no trial at all. At the present day, the hydraulic press is substituted, and by proper arrangements the strength of each part may be exactly measured, and anchors of different makes compared.

ANCHORS.

No less important improvements have been introduced in the manufacture of anchors. The experience acquired in forging the pieces of large steam-engines and the tools devised for the purpose, has been taken advantage of in anchor making, and for the "Hercules" worked by hand of former days, Nasmith's steam-hammer has been generally substituted. The fan-blast has also taken the place of the bellows, and the furnaces have been improved. The several parts of anchors are forged like any other pieces of machinery, either by piecing or by using blooms, and are afterward welded together. The process of annealing anchors after they are finished was formerly considered as absolutely necessary, and when anchors were very indifferently manufactured, it made the defects visible. Several makers are now of opinion that anchors not annealed are stronger and more elastic, and are satisfied with roasting the anchors but just enough to take away the polish produced by the hammer, thus giving them a better-looking surface. The proof-strains to be applied to anchors by the hydraulic press, are :—

Anchor. Cwt.	Strain. Tons.	Anchor. Cwt.	Strain. Tons.
100	67	40	35
90	63	30	28
80	58	20	20
70	53	10	12
60	48	5	7
50	42	1	3

The following is a table of approximate values of the properties considered essential to a good anchor :—

Essential properties.	Approximate values.
Strength	45
Holding	30
Quick holding	15
Canting	15
Facility of sweeping	15
" " stowing	10
Exemption from fouling	10
Fishing	10
Facility of transport in boats	5
Quick tripping	5
Total values	160

The changes effected in the machinery have proved as beneficial in diminishing the cost, as they have in improving the work.

ANCHORS.

Formerly an anchor of five tons weight would cost $2,000; a much better one of the same weight can now be sold for less than $1,250.

Patent Anchors. The preceding general remarks apply to all kinds of anchors, portable or solid. Of the numerous inventions which have been presented to the public, the following are most noteworthy: An iron stock is generally a round bar of iron with a collar near the centre. It is put through a hole in the square of the shank, the collar resting against one side, and being kept there by a forelock which passes through the stock on the other side of the square. As the chief argument in favor of the iron stock is the convenience of stowage, there does not seem sufficient reason for substituting it for the wooden stock for the large-sized anchors. On the contrary, the best authority is in favor of the latter.

As a general rule, stocks for anchors above 60 cwt. are made of wood.

Another plan to hold the stock is to pass a round pin through the centre of the square and of the stock; a stop is wrought on the stock in place of a collar to fit in a slot in the square. This plan admits of refitting by the process called upsetting, and avoids any hole being made in the stock near the shank, where the stock bears the greatest amount of pressure when the anchor is dragging. In both these arrangements, as well as in all other joints of parts which have to be separated occasionally, it is good to tin the pins, keys, and the surfaces in contact, to avoid rusting. An oxidation by sea-water can only be retarded by this process; it is also important to take the anchors to pieces once every three months, and to clean the joints before they have become too hard.

A Wooden Stock has generally a square section tapering both ways towards the centre; it is encircled with iron hoops, and a square hole is cut in the centre to fit it on the square of the shank. An improved plan is to make it of two pieces, by cutting it lengthwise, and to forge projections from the square to be enclosed between the two parts of the stock and furnish large bearings; the two halves after being put on are hooped together.

Wooden stocks are made of oak, in two pieces left sufficiently apart in the middle to give greater binding power to the hoops and to admit of their being driven up when the wood shrinks, a precaution which should be adopted after long exposure to a hot sun.

PLATE 65

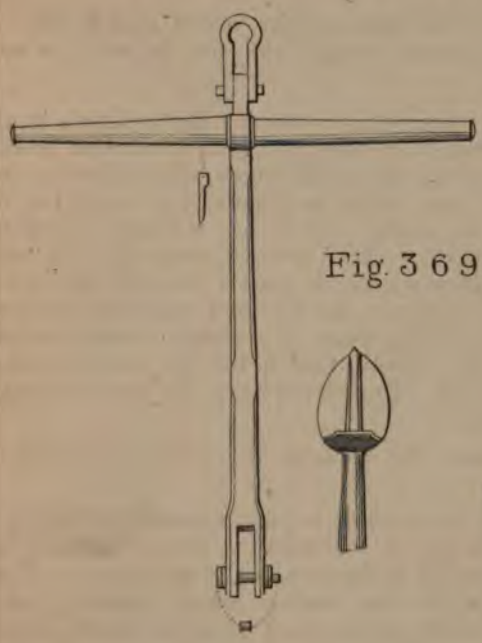
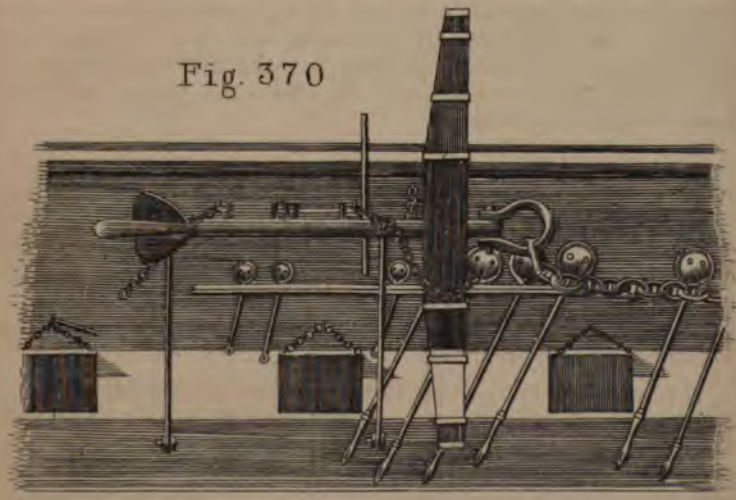
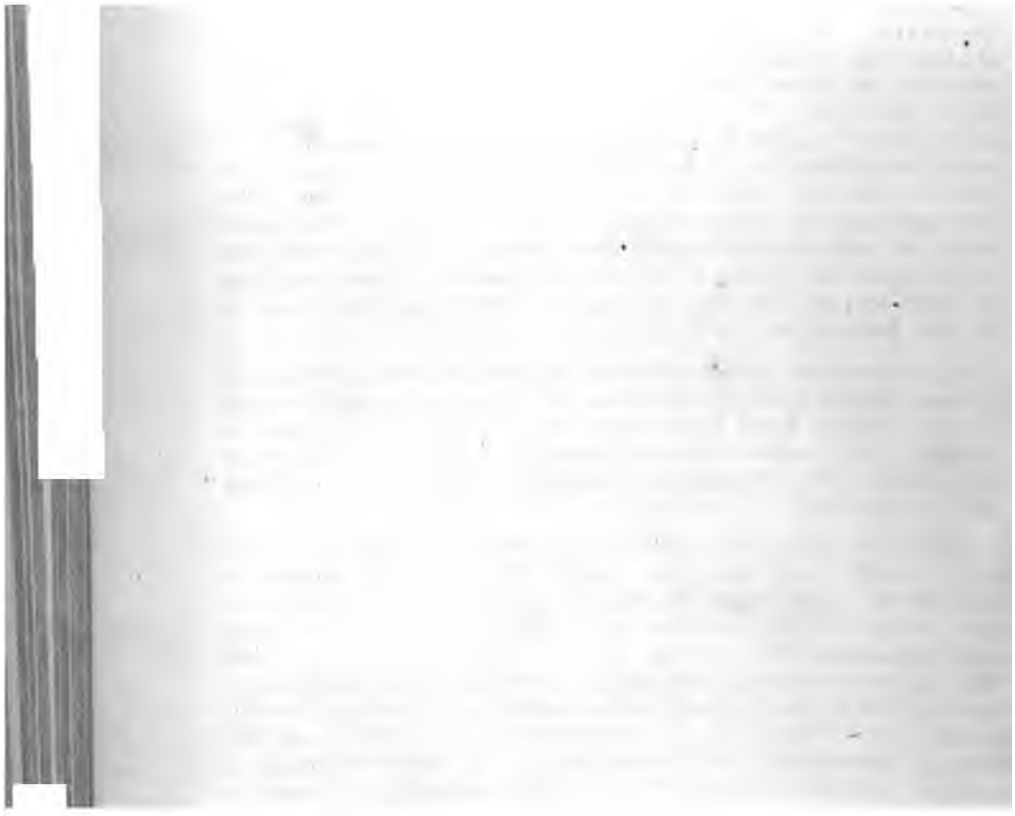


Fig. 369

Fig. 370





ANCHORS.

The two arms of a portable anchor, called flukes, are in most of them attached to the shank by means of a pin through the centre of the flukes, and through jaws forged on the end of the shank. The flukes may either be kept firm by forging lugs on them to embrace a shoulder on the shank, or they may move around the pin. In this case the extent of the motion may be limited by a second pin through the shoulder playing in a long hole in the flukes, or simply by the bills coming in contact with the shank. When the flukes are movable they have to be so shaped that when the upper arm is drawn as near the shank as possible, the other fulfils the proper conditions for holding, as above described. To force the arms to assume this position, it is necessary to provide each of them with a horn projecting outward just above the palm. This forms a secondary bill, which holds quick, and brings the arm in a position to hold also. The two arms may be forged separately, with a tenon at the end of each, by means of which they are fastened to the shank, on which mortises are cut to receive the tenons. Porter's anchor, as improved by Trotman, and known now by the latter name, is of this description, see Fig. 369.

Sometimes the anchor is divided lengthwise in two portions by a plane perpendicular to the arms, and passing through the axis of the shank. Each half of the shank is forged of a pin with one arm, both halves are bound together by hoops, and the stock is placed over the whole or through it, after one of the plans above described.

Attempts have been made to manufacture anchors of a character totally new. One plan consists is dispensing altogether with stock. The arms are movable on the shank around their own axis, and the palms are set in the same plane, that is, at right angles with their usual position. The arms are provided with a tumbler acting crown which holds fast and makes the arm revolve, thus bringing both palms lower than the shank, in which position they both hold. The proper amount of rotation of the arms is determined by the upper part of the tumbler coming in contact with the shank. For this arrangement many advantages are justly claimed. 1. It holds nearly as much as two anchors. 2. It will not foul or cut the cable. 3. It does not require a stock. 4. It does not impede the motion of the vessel in being hove up; will stow without projections; cannot injure the bows in weighing. 5. In the event of the ship grounding upon her anchor she cannot be injured.

The Mushroom Anchor. Another plan without stock is to substitute, for the arm, a cap or reversed cup, called parachute, making the anchor represent a mushroom.

One great advantage possessed by this anchor is, that it does not foul the chain, and for this reason it is used almost exclusively for our light-ships. They are known as *mushroom anchors.*

A *mushroom* consists of a heavy iron cup (the mushroom anchor without the shank), having on its convex surface a shackle. These are used for the anchoring of buoys.

The last novelty is an anchor with an elastic shank. The principle of having a spring between the soil and the vessel is undoubtedly excellent. Some kind of spring is even indispensable, as it may be safely said, that without the natural spring formed by the curve in the chain which unites a ship to her anchor, no practical arm or chain could resist the sudden jerks from a mass of several thousand tons, but the proper place for the spring is on board. The anchor is the worst place for the spring, as every time it plays, the chain harrows the ground, and on hard rocks would soon be destroyed.

Costell's Anchor (English). One of the best patterns for a solid anchor is "Costell's Improved Anchor," Fig. 368, Plate 64, which is constructed as follows:—

Draw two lines parallel to each other, whose distance apart shall be equal to the small of the shank, A B; on either line describe the equilateral triangle C D E, whose side shall equal the length of the arm; produce D E to F; E F equals the size of the throat; join F C, and bisect it in G; from the point G erect the perpendicular G M; then, with M as a centre, describe the curve C F C, and from the point K describe the arc G E; draw C L equal to twice C F; the point L will be the centre of the shackle-bolt.

The American Anchor. Enough has been said of anchors in general to enable one to understand and appreciate the excellent qualities of the American anchor. Plates 68 and 69, give a representation of our wooden-stocked and iron-stocked anchors, showing also the manner in which the arms are welded to the shank; *a a* shows a side and front view of the wooden stock; *b b* side and front view of wooden-stocked anchor of eight thousand pounds; *b'* one arm welded on in the rough; *c* the edge and centre of palms; *d* view of iron stock, key and washer shipped; *e* side and front view of iron-stocked shank; *f* side and front view of shackle.

These anchors withstand the most thorough tests, and have been found to fulfil every requisite condition.

To Mr. James Brown, master-smith of the Washington navy-yard, who kindly furnished these drawings, is the credit due for this pattern, probably the best extant.

PLATE 68

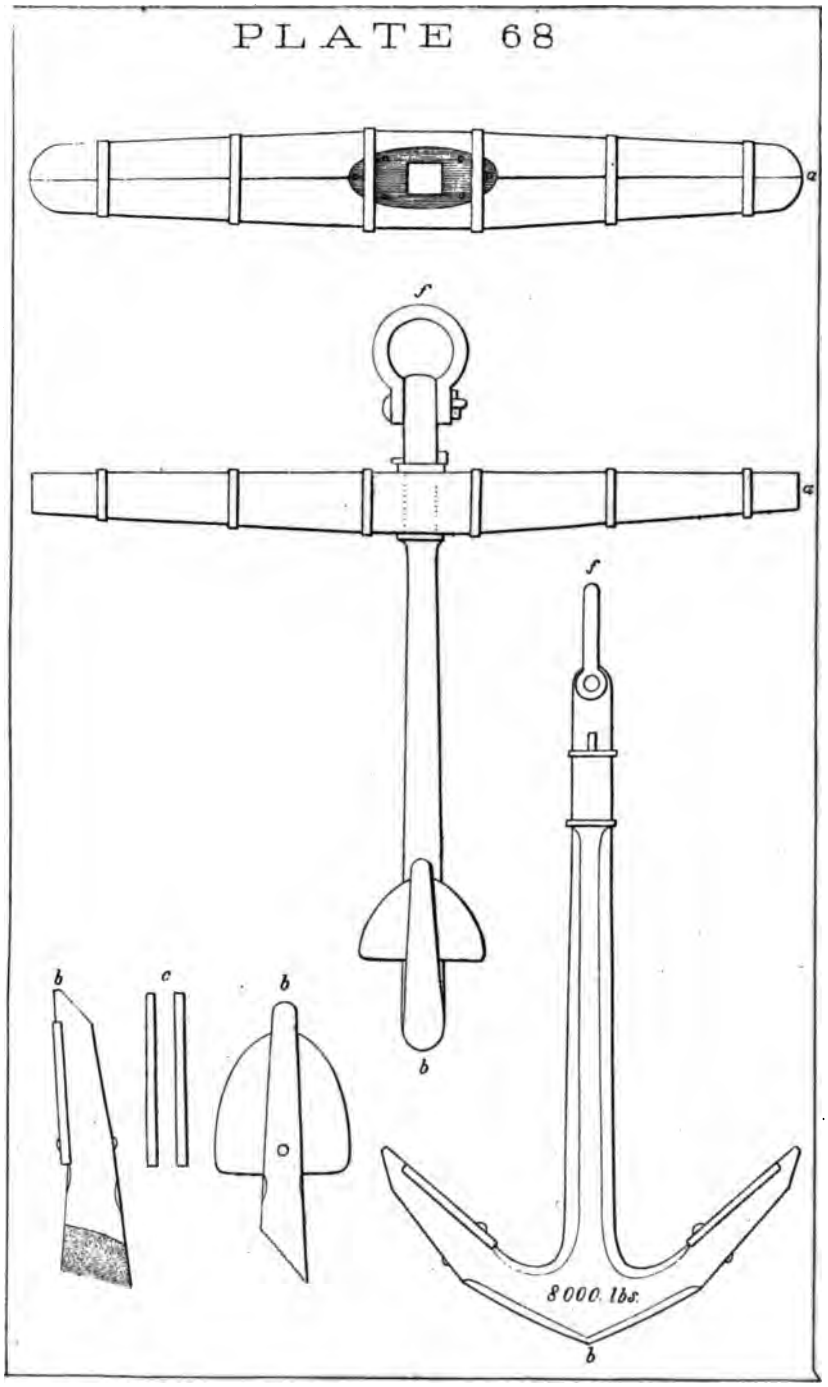
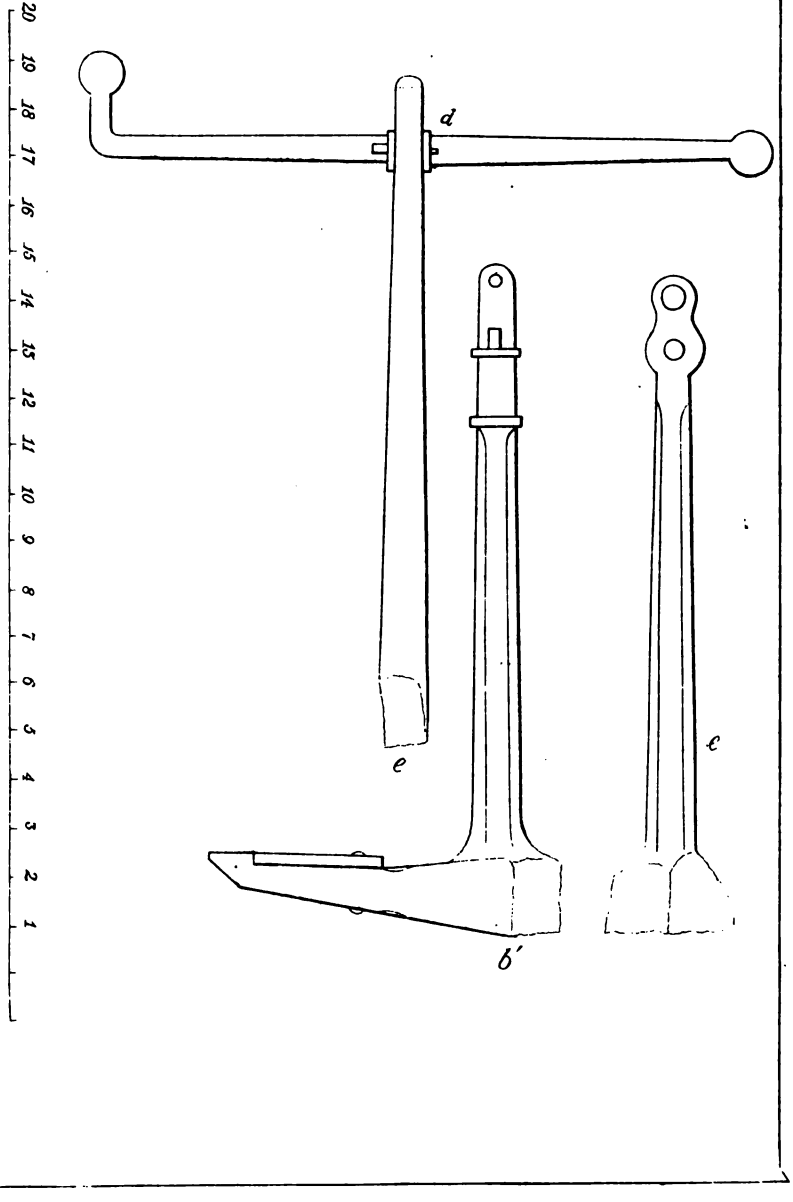


PLATE 69



ANCHORS.

Anchors are brought off to the ship in lighters. Having them under the bows, overhaul down the cat and fish, hook on, cat and fish the anchor, passing the ring-stopper and shank-painter, and bend the buoy-rope if used. It is recommended to bend a stout hawser to the ring of the anchor, in case of accident. It is also recommended to hook and pull up on the cat and fish together, for fear of injury to the lighter.

The method of getting the waist anchor into its berth has been given.

To Secure an Anchor for Sea. After passing the cat-stopper and shank-painter, the cat-fall is unrove from the cat-block and rove through the sheaves of the cat-head and the ring of the anchor (or any suitable piece of rope may be taken instead of the cat-fall); thus rove, hook the fish-tackle to it and pull up, having on the upper end of the stock, a "stock and bill" tackle to keep it up and down and the lower end clear of the ship's side. By this means the anchor is got chock up, and by fish and athwartship jigger, the inner arm is got on the bill board, when lashings are passed, and if a long passage is contemplated, the chains may be unbent and stowed below, and the hawse bucklers closed to and secured. Besides the stopper, a good lashing should be passed through the ring and over the cat-head, as well as around the stock and cat-head.

To get the Anchors off the Bows. Bend the chains first; hook the fore pendant tackles; single the shank-painters, and set them taut with the pendant-tackles; come up the shank-lashings and pry the anchor off the bill-board by a capstan-bar (or anchor-bar), easing down the shank-painter as necessary. Single and set taut the cat-head stoppers, and unlash the ring and stock.

To Stow the Sheet Anchor. The anchor rests on two shores. These may be of wood, resting in saucers and secured by a laniard, or they may be of iron and work on hinges as in Fig. 370, Plate 65. The object of the shore, beside supporting the anchor, is to throw it clear of the ship's side when let go.

To confine it to the ship's side there are two or more stout lashings of good, well-stretched rope, and a trip-stopper of chain under the lower arm of the stock. Or, as in Fig. 370, it may be secured by a slip-chain to the upper arm, a chain strap under the lower arm of the stock, and two chains round the shank secured to a tumbler, which being slipped, releases the anchor. When preparing for a gale at sea, stout lashings should be put on, and jumpers, if the ship lurches heavily.

The "General Admiral," built in New York for the Russian government, had every convenience for anchoring by the stern.

ANCHORS.

With our long ships it may frequently be found convenient, if not absolutely necessary, to anchor in that way; and for that purpose, with the sheet anchor thus secured and ready at any moment to let go, the chain may be led out of the after chain pipes, bent and stopped up as usual. Of course, this method of bending need not be permanent; but for particular occasions, such as for anchoring in a narrow channel with no room to swing, and you do not wish to trust to a kedge; coming to in a small or crowded harbor, or as the "Goliah" and her consorts anchored at the battle of the Nile.

Jury Anchors. Having lost the heavy anchors, a stream or kedge anchor and a gun may be combined, the one giving weight and the other holding power, so as to answer very well for a temporary anchor; a spare anchor stock, fish or any suitable spar being lashed across to serve as a stock, Fig. 371 Plate 66. At the trunnions would be the best place for securing the stock, but it has been placed clear, in the figure, to show the manner of securing the kedge and strap to which the chain shackles. A heavy anchor with a broken shank may be treated in the same way.* This plan was suggested by Admiral Porter.

Milne's Jury Anchors, Fig. 372. A jury anchor has been formed with broken shanks and flukes thus: The two shanks were carried close out to the palms of the anchor, on opposite sides, and then lashed with top-sail sheet chains. The two stocks were secured together with chains of the same description. An iron bar was lashed across the shanks, securing in the centre the remaining piece of the shank. A length of stream chain was then passed round the rings, down along the shanks, with a round turn round each palm and shank, then back and secured. By this means, when strain comes on the arms, it is thrown on the chain by the shanks being inclined to draw through the small lashings: while in so doing, the stream chain acts as a vice, and the more the shank draws, the firmer is the arm grasped by the round turn of the stream cable, while the stream cable prevents the shanks from drawing out altogether. This anchor was found quite efficient.

A whaler that had parted, brought up, and rode out a heavy gale in Table Bay, by slinging and letting go a boiler with a cable made fast to the spans.

Guns are a resource, when without anchors. Haul the cable from the hawse-hole along the side, by a warp from aft, keeping it up with slip ropes from the ports, and lash it to a certain number of guns round their chase; pass the end of the breechings round the cable, and secure them on the top of the gun; heave

* Jury anchors should be lowered to the bottom by slip-ropes.

PLATE 66

Fig. 371

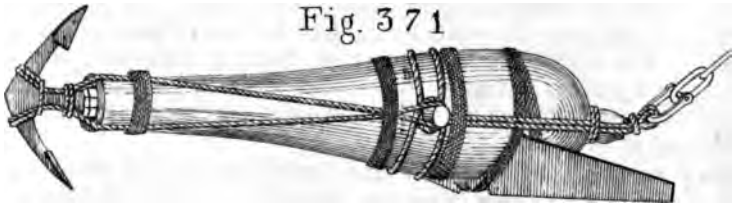
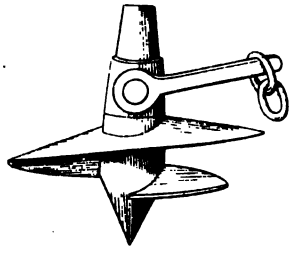


Fig. 372

Fig. 373



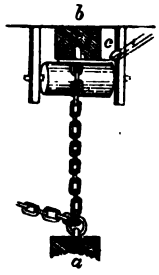


Fig. 374

all overboard together. In weighing them, hoist them with the cat, as they reach the hawse-hole, and take them in through the bow-port.

Mitchell's Screw Anchor, Fig. 373. There are also very powerful screws made use of for mooring purposes, which, having a broad flange nearly four feet in diameter, present a resistance, when entered into the ground, equal to that of ten square feet. This is not only much greater than that of an anchor, but is less liable to be fouled by other ground tackle.

The chain is connected with a revolving collar. The screwing down is effected by a key, which is placed piece by piece as the screw is lowered; the collar admitting of the turning, without fouling the cable. When the screw has been sunk to the desired depth, the key is removed.

The foundation for the light-house on Mapling Sands was formed on pilings shod with these screws.

Another jury anchor is one proposed by Capt. Belcher, R. N., and made of pigs of ballast and a pair of movable flukes. It seems hardly practicable with our ballast.

A Sea Anchor. This anchor may frequently be of the greatest possible use, and may be made in the following manner: Take three spare spars (top-gallant studding-sail booms will be sufficiently large), with these form a triangle, the size you think will be large enough, when under water, to hold the ship; cut these spars to the required length, before or after cross-lashing them well at each angle; then make fast your spans, one to each angle, so that they will bear an equal strain when in the water; but should your spars be weak, you should always increase the number of spans accordingly; fill up the centre of the triangle with strong canvas, having eyelet-holes round its sides, about three inches apart, to which eyelet-holes attach the canvas securely to the spars; at the back of the canvas pass many turns of inch or inch and a half rope, net fashion. A proper net would be preferable to rope so expended. To the base of the triangle attach a weight, or small anchor, supported in the centre of the base by a span running from each of the lower angles. To the first-mentioned span make fast the stream cable. When everything is quite ready, hoist or put it overboard from the place you think it will answer best. There is every reason to believe that with this anchor under the trough of the sea, and seventy or eighty fathoms of stream cable out, that a ship's drift would not be very great. * I have tried a similar contrivance twice, and it answered beyond my expectations. The plan proposed would

* Captain Francis Liardet, R. N.

be of the greatest advantage to dismasted vessels, and vessels which have lost their rudders, &c. It appears preferable to riding by spars, as they drift so much faster than the sea anchor, just described, from its being well under the trough of the sea, and so makes great resistance to the drift of the vessel. A triangular form is proposed in preference to the square, that the sea may strike as lightly as possible, should the upper angles at any time approach the surface. If a ship should approach the shore with this sea anchor down, it would enable her to bring to with her proper anchors much easier than if the sea anchor had not been down. She might let go her proper anchors and veer from the sea anchor, until she had sufficient cable out, which would give her a much better chance of holding. The sea anchor should have a buoy and a buoy-rope sufficiently long to let the anchor go well under the trough of the sea.

Another plan is to have two flat bars of iron, each in length half the breadth of the vessel's midship beam, riveted together in the middle by an iron-saucer-headed bolt, clenched at its point, that they may be swung parallel to each other, for easy stowage. At each end of the bars is a hole for a rope or swifter to pass through, which must be hove tight to extend the bars at right angles. To this swifter is marled a double or fourfold No. 1 canvas cloth, of the same shape, and put on the side of the frame nearest the ship when used. At equal distances in the bars are holes to which is attached the bridle or crows-foot for bending the cable or hawser. Also have a ring at one of the angles for a buoy-rope, which should be from ten to twelve fathoms long. The buoy prevents it from sinking to the bottom, and facilitates getting it on board again.

Blockading vessels on an open and exposed coast might use this anchor with great advantage, during bad weather.

CHAIN CABLES.

It appears that as early as 1634, a patent was obtained by an Englishman of the name of Philip White, a blacksmith, for mooring ships with chains.

Again, in 1804, John Slater, a surgeon in the English navy procured a patent for chain cables, but, from want of capital or other causes, it does not appear to have been successful. It was not till 1808, when Samuel Brown, a lieutenant in the English navy, introduced a "great improvement in the manufacture of cables of iron chains," that the subject seems to have attracted serious attention. Since that time chain cables have gradually

grown into favor, the hemp cable yielding step by step, until now they are scarcely ever seen on board ship.

Cables for the navy are made at the Washington navy-yard. An iron rod of the requisite length and diameter is shaped into a link and a stud put in, another piece of iron of the same dimensions is put through the link just formed, and shaped as before; thus fifteen fathoms are made, when a shackle is formed for connecting it to a second length, and so on for one hundred and eighty fathoms, or the required length, when we have the anchor shackle and club-link.

At certain intervals along the chain there are placed swivels; were it not for these and the studs or stay-pins, the chain would soon get full of kinks, and become unmanageable.

The stud is said to add one fourth to the strength of the link. The end links have no studs, in order to facilitate the operation of shackling but the wire of these links is made the same diameter as the cable next in size, or one eighth larger than the other links.

It is found that by running around the bitts, the chain throws turns in its *after* part, which turns have a tendency to work aft and into the part leading into the locker; consequently we find sometimes, on veering, that the chain is so twisted up that it will not pass through the chain-pipe. These turns must be taken out, and hence the use of a swivel. The studs, besides giving strength to the link, prevent the chains from getting into an inextricable snarl in the lockers.

When a length of chain is finished it is put into a hydraulic testing machine and proved.

Rule to determine the Size of Chain Cable corresponding to an Anchor of a Given Weight.—Cut off the two right-hand ciphers of the number expressing the anchor's weight in pounds, and multiply the square root of the remaining quantity by 4; the result, deducting 3 when the anchor's weight is of and over 8,000; 2 when it is between 7,000 and 8,000; 1 when it is of 7,000 or more than 4,000; and nothing when it is of or *less* than 4,000 will show the diameter of chain in *sixteenths* of inches. Thus:

Weight of anchor, in pounds..... = 5,000
Cut off two right-hand ciphers, leaves = 50
Square root of 50..... = 7.071

$$7.071 \times 4 = 28.284 - 1 = 27.284$$

to show the diameter in *sixteenths* of inches; and $\frac{27}{16} = 1\frac{11}{16}$, which is the size required for an anchor of 5,000 pounds.*

* For length of Cables see Book of Allowances.

CABLES.

The size of a chain messenger is *two thirds* that of the chain cable to which it is to be applied; and the length, of course, is to be determined according to circumstances.

Marking Cables. Although the chain cables are marked by a shackle at every fifteen fathoms, still the number of the shackle cannot always be known, and to mark these, several different methods have been suggested. The most common and probably the most successful plan is to put around the stay-pin of the link next to the shackle-link one or more rings of iron wire, one ring denoting fifteen fathoms from the anchor, two rings thirty fathoms, and so on; and the value of this mark may be further increased by putting it on the link which corresponds, in number from the shackle, to the number of turns of wire; for example, for the fifteen-fathom shackle, put one turn of wire on the link next to the shackle-link; for thirty fathoms, two turns on the second; forty-five, three turns on the third, etc. When heaving in chain, however thick the mud may be, these rings can be felt; but the trouble is, they get knocked off when working cables. Another way is to have the shackle numbered by Roman letters, cut with a cold-chisel; but these marks get filled up with mud, and at times cannot be distinguished. On some chains every fathom is marked by large figures cast on the stay-pin; but these, too, get choked with mud; and besides it often occurs that lengths of chain get shifted, when, the regular sequence being destroyed, these marks are of no value. Still another way is to paint the shackle and one link each side of it; for instance, let the first shackle be painted red, the second white, and the third blue. Now, however thick the mud may be, enough can be washed off to discover the color beneath.

There seems to be no good reason why shackles should not be clearly, distinctly and substantially marked at the foundry, as it is a matter of considerable importance.

The shackles are put on so that the rounded part will be forward.

Shackle-pins. The pin for the shackle-bolt is made of iron, and should be white-leaded before putting in. These pins sometimes, through neglect, become rusted, when it is almost impossible to unshackle. Should this occur at a time when it is desirable to slip suddenly to avoid danger, as fire for instance, the neglect might occasion the loss of the ship; and there are instances on record of vessels having been lost from not being able to unshackle and get clear of their chains after parting from their anchors, for it would be impossible for a ship to claw off a lee shore with a chain dragging after her; while, on the other hand, several instances, in our navy, are related of ships getting

adrift from their chains coming unshackled. Hence, at least once in each quarter, the chains should be overhauled, the pins backed out, carefully white-leaded and replaced.

Wooden pins have been tried, but they get dry, shrink and fall out or rapidly decay.

Steel-*tinned* pins would be found serviceable. The length of the steel pin should be such that the extremities do not come through the shackle by the diameter of the point, and they should be fitted with dovetail chambers, to receive leaden pellets in the ends.

Getting Chains on Board. When lying in the stream the chains are brought off in scows or lighters, where they are ranged regularly in alternate layers fore-and-aft and athwart-ships, and the *bitter* end being passed through one of the vacant hawse-holes they are got on board and into the lockers by means of deck-tackles and chain-hooks. When working with the crew, men are stationed to stow the chains and are called *tierers*. The cable is paid down a few links at a time, while the tierers with chain-hooks and a hook-rope rove through a tail-block at some convenient place above them, in the after part of the locker, range the chain in regular fleets, using the hook-rope to form the after bights.

Prior to the stowage of the chains, however, it becomes necessary to secure the end below, as a preventive from loss, in the event of being unable to check its outward passage in veering; and perhaps the best method for accomplishing this object is the following: Through a ring-bolt in the keelson, Fig. 374, Plate 66, the end of the chain is rove up to an iron roller, attached to a beam *b* of the lower deck, immediately above—the last link of the chain being curved, in order to fit over a short perpendicular arm on the surface of the roller, which is kept from turning by a check-lever, *c*, having a small tackle attached. In the event, then, of having to *slip*, it only becomes necessary to haul on the jigger, which permits a revolution of the roller, and disengages the link from the arm.

Another very good plan is to have the end secured with a slip-stopper, Fig. 385, Plate 73, the tongue of which may be lashed down. But however the end may be secured, *it should not be at the bottom of the locker*, but out clear where it can be got at when required. This will enable a second cable to be shackled to the bitter end of the riding cable without rousing the entire length out of the locker.

Should the ship be alongside the wharf, *chain-shutes*, leading from the wharf through a port abreast the chain pipes are used.

The shute is a strongly-made wooden trough sufficiently wide and long for the purpose.

To Bend A Chain Cable. Reeve a ring-rope through a tail-block on the cat-head, or through the ring of the anchor, through the hawse-hole, and bend it to the chain with a rolling-hitch a short distance from the end, to which it must be stopped. Rouse it out (using the fore-bowline as a hawse-rope if convenient), and up to the cat-head, where the armorer shackles it to the ring of the anchor. If the cat-head is far from the bows, a slip-rope will be required to hang the cable half-way.

To Bitt a Chain Cable, Fig. 375, Plate 67. Immediately over the bitt-head is placed an eye-bolt, to which is hooked a single block, having a hook-rope rove through it. Sufficient slack chain having been roused up, hook on to a bight and pull it up abaft and over the bitt-head; form a cuckold's neck in it, so that the part leading from aft shall rest on top of the cavil and outside the bitt-head, the running part being inside and leading down under the cavil and so forward; shove the bight thus formed over the bitt-head, slack down the hook-rope and it will fall in its place. Now rouse the chain taut along the deck and pay the slack down into the locker.

To Weather-Bitt a Cable is to take an additional turn with it around the cavil or bitt-head.

To Unbitt, as when getting under way. If the messenger is passed, "bring to" forward of the bitts, and when ready "*heave round;*" when slack enough is in for the purpose, "*avast heaving,*" unbitt the chain, and report "*All ready forward for heaving in.*" If the messenger is not passed, screw down the "Mix"-stopper, or put on any adequate stopper forward of the bitts, take off the deck-stoppers, bend on a hook-rope, rouse up enough slack and unbitt.

To Range a Chain Cable, Fig. 375. Bend on a hook-rope or a chain whip, according to the size of the chain, rouse up the requisite quantity, and range by placing it in parallel lines called *fleets*, fore and aft the deck between the bitts and the chain pipes, observing to let the part leading from the bitts, the running part, be outside of all, that from the chain pipe being inside; for were it reversed, the chain running out would find the last fleet forming a curve from the bitts, out towards the ship's side, and in again to the chain pipes, and as the strain came on it, it would sweep with immense force amidships, injuring anything that might be in its way, at any rate giving a violent surge. Chains are rarely ranged, at present, for any considerable length.

PLATE 67

Fig 375.

Fig 376

CABLES.

The cable being bitted and clear for running, the anchor may be let go, and allowed to take the chain from the lockers, and such is the common practice; but sometimes, especially with new-fashioned bitts, the chain hangs, in the most unaccountable manner, and renders the anchors liable to injure the bows. For this and other reasons, which experience alone can teach, it is found advisable to rouse up and range a few fathoms abaft the bitts, just enough, say, to permit the anchor to reach the bottom, and no more, after which let her take the chain right from the locker, checking it at pleasure with the compressors.

Check Stoppers. Should it be desired, however, to range a chain for coming to, a safe way is to range it abaft the bitts, and put on check-stoppers, at every few fathoms, of small strands of old rope, which, parting as the strain is brought upon them, checks the cable as it runs out.

If too much chain is ranged it is likely to pay down over, and foul the anchor. When the anchor is let go suddenly, while headway is still on, to avoid danger, for example, or when anchoring in a strong tide, or fresh breeze, the chain will soon acquire very great velocity, and if permitted to run too much at a time it will be found almost impossible to check; therefore but few fathoms should be veered at a time, checking it with the compressor before getting too much headway.

A line-of-battle-ship, some years since, was going down New York harbor, in tow of a couple of tugs, a strong ebb tide running at the time. The ship was about to proceed to sea, when the pilots, thinking the water on the bar too scant, suddenly determined to anchor. The starboard anchor was accordingly let go, the ship meanwhile passing rapidly over the ground. The chain commenced running out with great rapidity, and violence. In vain the compressor-men essayed to "haul to" the compressor, it would not nip. On went the chain, until coming to the bitter end, secured with *rattling stuff* to a ring-bolt in the keelson, it parted the lashing instantaneously, and, undulating like a vast serpent, went overboard with the rest.

A similar accident happened to a sloop-of-war on the Orange Banks, coast of Patagonia. Standing in for the land under double-reefed topsails, the leadsman called out "soundings" so shoal that every one was startled. Being uncertain of the ship's position, it was determined to anchor. With little delay, the starboard anchor was let go, and the same scene ensued, precisely as that just described; the chain being secured in the same manner. Upon getting more careful soundings it was ascertained that the ship was in eighty fathoms.

CABLES.

HEMP CABLES.*

Being occasionally found on board the larger class of vessels, it may not be amiss to refer to them.

Custom has heretofore limited the length of all cables to one hundred and twenty fathoms, for the reason that private rope-walks are seldom long enough to lay up strands of greater length, as a cable will take up one third from the drawing down of the yarns in laying up. In the United States ropewalk, at Boston, cables have been made one hundred and thirty-five, and could be made one hundred and forty fathoms in length.

The cables are taken from the rope-walk, and coiled against the sun upon a car having a large hole in its bottom, and after being transported to the vessel, or lighter, at the wharf, the upper end of the coil is passed down through all the fakes, and through the hole in the bottom of the car, then coiled away again in the lighter. By dipping the end in this manner, grinds or kinks are prevented, and the cable is got into the lighter, with only one turn in it.

On receiving the cable in the lighter which is to convey it alongside the vessel, you should coil it *with* the sun, by which each fake takes a turn in the cable.

The lighter being towed off to the ship, hauls under the bows; place mats in the sides and sills of one of the forward ports; get the cables in on deck, and French-fake them fore and aft against the sun. They are now with the same number of turns in them as when they left the ropewalk. See that the tiers are clear, and that the gratings are properly placed, and swept clean, for the cable to lay on. Pass the end of the spare one below, and *coil away with the sun*, on the starboard side of the tier; make the coil as large as possible, taking care not to have too many fakes in a sheave, as the inside strands of the inner ones would be injured by breaking in.

In coiling a cable in the tier or on the deck, every oblong or circular figure formed, is termed a *fake;* and when several of these are formed, one within the other, the whole is termed a *sheave.*

Shot is a term used when there are two or more cables spliced together; thus, the bower or sheet cable may consist of two or more shots. When of but two, the inner end of the lower one and the outer end of the upper are crowned or capped, and the other ends tailed and spliced together. When there are three

* Obsolescent.

shots, the ends of the centre one are tailed and spliced to the tail ends of the upper and lower.

The lower ends of cables are secured around the orlop deck beams, or around the mainmast.

Hemp cables are coiled in tiers *with* the sun, crossing in the hatchway; that is, the starboard one is coiled in the port, and the port one in the starboard tier.

After forming the lower sheave, the cable is taken out to the sides of the tier, and another sheave formed over the first, and so on; leaving room in the centre of the tier, in which may be coiled hawsers, or where may be stowed nippers, deck-stoppers, &c.

Crown-Ropes are used in the corners of the tiers to keep the fakes in their places.

To French Fake a cable or hawser along the deck, the bends are made to lap, one over the other, and the different layers between the bends form parallel lines on the deck. This is the proper manner of coiling a cable or hawser for running; the bending end form the first fake, and is taken out towards the ship's side, and each succeeding fake approaches nearer to a straight line between the hatch and bitts, each bend underlapping the former one. Thus the running part of the cable or hawser will always form the upper fake.

To Bend a Hemp Cable. Rouse it out of the tier by means of the hook-ropes, and having its ends forward by the hawse-hole, reeve the ring rope, thus:—

If for the starboard cable, reeve it through the ring of the anchor, from in out; pass the end in at the inner hawse-hole, and bend it to the cable with a rolling-hitch a short distance from its end, to which it must be stopped.

The ring-rope for the port cable is rove through the ring of the anchor, from out in, and secured to the cable in the same manner as the starboard one.

Man the ring-ropes and rouse the cable out of the hawse-hole and through the ring of the anchor; when far enough out to allow for clinching, stop it to the ring. Make an inside clinch, *with* the sun, with the end around the other part. Put two bends on each clinch, one around the end of each and its adjoining part, and the other opposite to the end ones around both parts.

The *bends* are passed on the bights, and are crossed with sennit.

CABLES.

When bent, haul the clinch close up to the ring of the anchor, and rouse the cable in taut by deck-tackles.

A clinch should always be smaller than the ring of the anchor.

To Mark a Hemp Cable. Put on one round turn of spun-yarn at five fathoms from the clinch; two round turns at ten; one knot at fifteen, two at twenty; one knot at twenty-five, and three at thirty; one at thirty-five, and four at forty; and so on.

To Range a Hemp Cable. Having bent it, rouse up in the same manner from the tier, a scope for the requisite range, and French-fake it fore-and-aft the deck, inside of the first part, or that attached to the anchor.

To Bitt a Hemp Cable.* The port one should be bitted *against*, and the starboard one *with* the sun, thus: Suppose the cable lying fore-and-aft the deck, under the bitts. Raise the cable up abaft the bitts, and place the bight over the bitt-head, so that the inner end of the cable shall lead from the outer side of the bitt-head to the hatch. This is a rule for a hemp as well as a chain cable.

To Stopper a Cable. For a hemp cable, deck-stoppers and dog-bitt stoppers are used. Abaft the bitts are three deck-stoppers, passed thus: Place the stopper in the lay of the cable, and pass the laniard around the cable and stopper *against* the sun, leaving a fathom of the end to worm forward in the lay of the cable. Forward of the bitts is another stopper passed in the same manner. And a bitt-stopper (used principally in heavy weather) is passed thus: Put the bight over the tier part of the cable, abaft the bitts, take the ends under the cross-piece and dog them forward of the bitts around the cable. Or it may be used thus: Having passed it through the hole in the Sampson's knee, the two ends are passed around with dogging turns, and the ends seized to the cable.

Ring-Stoppers are also very useful and neat. The bights are passed over the cable abaft the ring-bolt, both ends are rove through the ring, and dogged around the cable forward of the bolts; the ends are tapered, coach-whipped, and laid up in a square sennit. These may be used for chains also, Fig. 384, Plate 73.

* The expression of bitting a starboard (or port) cable, whether *with* or *against* the sun, has always been a favorite subject for discussion in the steerage. But regarding the forward part of the chain as fixed, the slack is hove over the bitt-head, say the port side, *against* the sun, as will be seen by coiling down a rope in that way.

CABLES.

Instead of bending the hemp sheet to the anchor, and exposing the rope to wet and chafe, it has been found very convenient to attach to it a length of chain to reach from the tiers to the ring of the anchor. This length of chain is called a *ganger*.

Gangers. There are two ways of tailing a length of chain to a hemp sheet cable: one by forming an artificial eye in the cable and joining the chain by shackle, known as Admiral Elliott's plan; the other by attaching three small chain tails to the end link of the large chain, and with them forming a splice with the three strands of the cable. In ten trials with the eye in a testing machine, the rope broke once; and in nine trials with the splice, the rope or the eye was broken eight times. The splice has therefore an advantage in point of strength, as well as in other respects.

Splicing Tails, of the different sizes, for connecting iron and hempen cables together, are each to consist of one end link, without a stay-pin, followed by one enlarged link, fourteen common links, and then another enlarged link, all with stay-pins, and all the before-mentioned links are to be of the same size as those of the iron cable to which the splicing tail is to be attached; also of a triangular link, no wider nor longer than necessary, of iron one third diameter of that of the common links, connected at its narrow end with the last-mentioned enlarged link, and at its broad end with three short-linked chains (without stay-pins), called tails, the first link of each of which connected with the triangular link, is to be of iron, eight tenths diameter of that of the common links, and the remaining links of each tail, about sixty-five in number, are to diminish gradually in size to iron of one fourth of the diameter of that of the common links before mentioned.

Splicing Hemp and Chain Cables Together. Three chain tails being shackled to the end link of a length of chain cable, pudden, by laying strands of yarn along them; lay a 3-inch rope tail in with each; then marl down, parcel, and marl over. Put a whipping round the hemp cable, unlay the end, and unlay each strand; pick out the outside yarns, lay the strands of each strand up again, splice a 3-inch tail into the three strands of the cable, make the outside yarns up into sennit, and graft the splices of the tails over. Being now ready for splicing, lay the chain tails up for a short distance, and then short-splice each cable into the other in the ordinary way. Three seizings are next put on over the splice, the centre one of two inches, and the quarter ones each of one inch and a half. The tails are wormed along the cable, and secured with a couple of flat seizings, snaked.

CABLES—THE CAPSTAN.

An Elliott's Eye, Fig. 376, Plate 67. Put a whipping on the bending end of the cable, a couple of fathoms from the end, and unlay it; splice two strands together with a long-splice, making the eye thereby formed equal in length to the diameter of the thimble and the breadth of the seizing. Then, with the remaining strand, make an eye-splice to come fair with the bight of the two strands; get the cable on a stretch and fid out the eyes thus formed; put a piece of rope between the two to fill up the hollow and hitch them over. On removing the fid, thrust in an oval cut thimble large enough to receive the pin of a chain shackle, having it well tarred and parcelled. Seize the thimble in with a round seizing of one inch and a half. Tail stuff on to the ends of the eye-splice, and worm it four or five fathoms down the cable, clapping on stops every four feet or so, to the end of the worming.

The Elliott-eye is not used in the service for cables, though it might be very advantageously applied to the ends of large hawsers, having two or three links and a shackle attached, for towing, mooring, &c.

HAWSERS.

Not counting stream-cables, the largest hawsers found on board our ships are eleven inches in circumference, and from that they decrease in size to four-inch towlines.

In the chapter on Rope it was said that plain-laid is stronger than cable-laid rope. For this reason and because cable-laid rope, especially when new, is difficult to handle, it has been suggested that all manilla hawsers and towlines should be *plain*-laid; and that hawsers of five-inch and over should be four-stranded, while all under that size be three-stranded.

For convenience of bending to anchors, and to each other, it is also recommended that an egg-shaped thimble (Fig. 376, plate 67) be spliced into each end of every hawser; the thimble to be fitted with one link, and to have a shackle to correspond.

A Mooring Swivel is an arrangement for putting on a vessel's cables, when moored, to prevent getting a foul hawse. (See MOORING.)

Clear-hawse gear will be described when used. (See MOORING.)

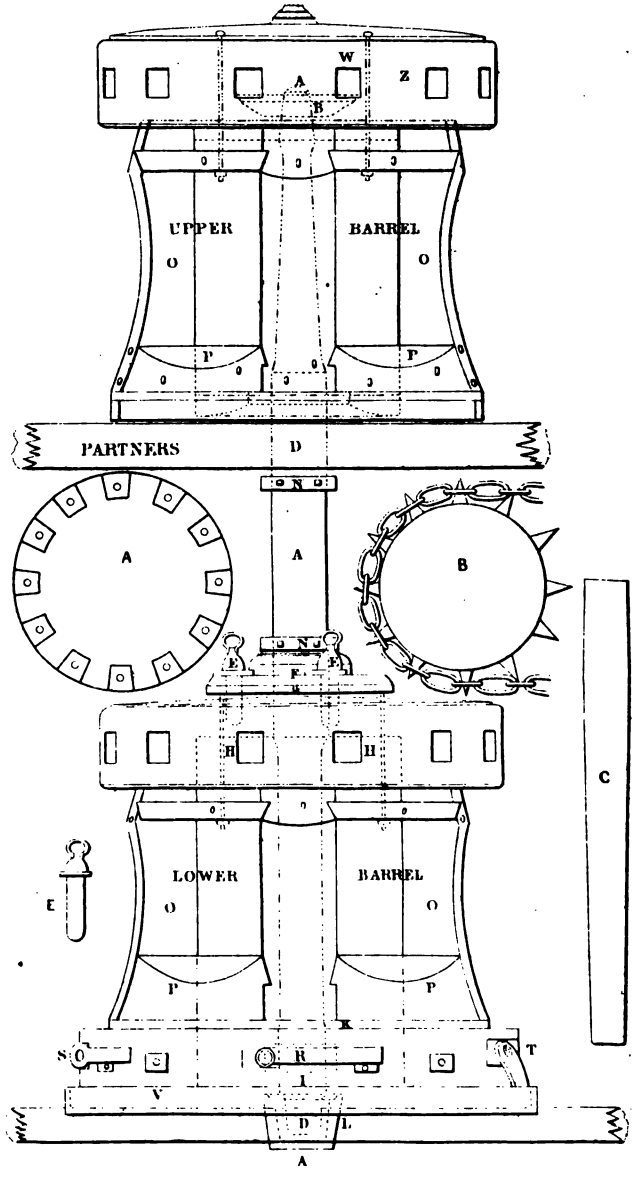
THE CAPSTAN.

The mechanical power employed in ships to heave in the cable, and thereby raise the anchor, is a modification of the wheel and axle; it is technically denominated a capstan, one portion of which, called the barrel. around which the rope is

PLATE 70

Fig. 377

Scale $\frac{1}{4}$ of an inch to a foot



THE CAPSTAN.

wound, answering to the axle of a mechanical machine; the other part, the head with the bars, being analogous to the wheel. To set this machine in motion, a moving power (the crew or ship's company) is applied to the bars of the capstan or wheel, and the rope being by this means wrapped around the barrel of the capstan, the weight or cable is raised. The cable itself is not generally attached to the barrel of the capstan, but is connected with it by the intervention of a rope or chain called a messenger, which does pass around the capstan, and is made to unite itself firmly to the cable by nippers. The messenger is a rope or chain formed into a long loop, and in length, when of rope, so as to allow of three or four turns around the barrel of the capstan, and then for each part to reach to the hawse-holes, the two ends being there united to form an endless rope. When a chain messenger is used, the links are worked over studs placed on the capstan, as shown by Fig. 377 (B), Plate 70, which decreases the length by the three or four turns around the barrel of the capstan, which are required when a hempen messenger is used to withstand the strain brought on it, and prevent the messenger from slipping around the barrel.

REFERENCES TO PLATE OF THE CAPSTAN.

Fig. 377. Elevation of a double capstan or of such as are usually fitted to frigates. The upper barrel comes on the quarter deck, the lower barrel being on main deck, on which the hawse-holes are also placed.

A A A, Iron spindle extending from the upper point A to the lower point marked A. This spindle should be well forged, and should be of the best materials, the whole strength of the capstan depending thereon; it is also placed in a turning lathe, by which the cylindrical form requisite to make it work accurately is insured.

B, Hoop and plate on the tenon of the upper barrel, by means of which the barrel is united to the spindle A at the upper part.

C, A similar plate and hoop for security of the lower end of the upper barrel of the capstan.

D, Hoop in the partners of the upper deck working in a metal bush or socket, thus forming a support for the spindle A to work in through the partners or deck.

E, Drop pauls or pins to connect the upper and lower capstans. The spindle A passes through the lower capstan without being united to it, or in other words, the lower capstan has free play or movement round it.

THE CAPSTAN.

F, Upper connecting plate, which is strongly secured to the spindle A.

G, Lower connecting plate, which is let firmly into the drum-head H; in F and G corresponding holes are made to receive the drop pauls (E). To attach the lower capstan to the upper one, or to the spindle A, the drop pauls, E, are let down through the corresponding holes for their reception in the connecting plates F and G, by which the drum-head of the lower capstan, and thence the barrel of it, is made one mass with the upper capstan. This power of connecting and disconnecting the two barrels or capstans gives the facility of using the capstans at one and the same time for separate purposes—the one of heaving the cable in, and the other to raise the lower yards or the topmast.

I, Paul head; receiving the pauls or stops to prevent the recoil of the capstan.

S, A paul of iron swivelling on a bolt, which is shown in the position in which it is placed when not required for use.

T, The paul down and in use—the lower end being dropped into the paul rim V against a stop formed in it.

V, Paul rim or racket, let down into the lower partners and bolted firmly to them; indeed, on the security of this rim the safety of the men at the bars mainly depends, and care should be taken in fitting it. The plan section of the paul rim is described by Fig. A.

L, Metal step or socket for the lower end of the spindle A to work in.

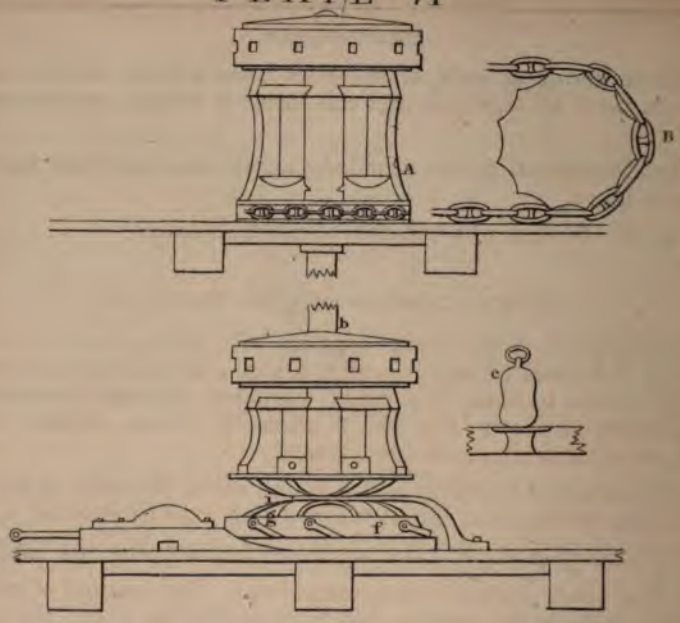
N, Collars or stops on the spindle A; the upper one is necessary to keep the capstan from rising, which it would prevent by its coming in contact with the underside of the partners at D; the lower collar prevents the lower capstan, when used separately from the upper, from rising by its forming a stop to the upper connecting plate F, should the lower capstan be forced up while in use.

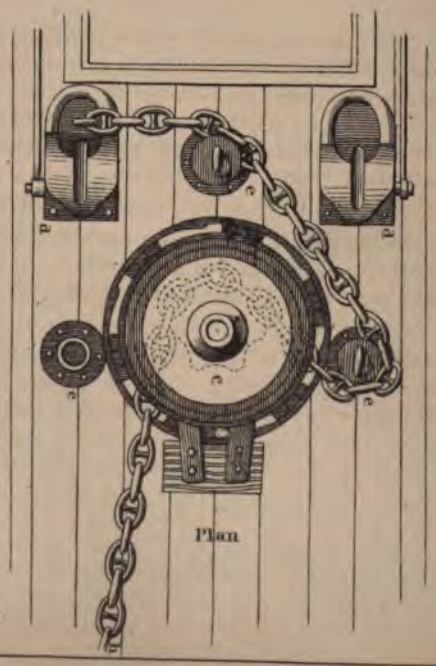
O, The whelps or ribs of the capstan; they are formed in a curve to give the surge which is required to prevent the turns of the messenger on the barrel of the capstan from rising too far.

P, Chocks placed between the whelps to steady them.

W, Holes, termed pigeon-holes, to receive the bars which work the capstan; to secure these bars when shipped or in place, holes are sometimes bored down through the head of the capstan and through the bars, and pins are placed in them, and in

PLATE 71





addition the outer ends of the bars have a rope wound round to join them all together, and the latter is termed *swiftering the bars.*

The drum-head is the circular part on top, in which are the pigeon holes.

Fig. c. Section of a capstan bar, not on scale.

BROWN'S CAPSTAN. FIG. 378, PLATE 71.

b, Elevation of the lower capstan with fittings at the lower part of it formed of iron, the ribs, *g* and *g*, in it acting like teeth or sprockets to clasp the cable, similar to the sprocket-wheel with studs as shown, Fig. 377, B, Plate 70, of the common capstan, when a chain messenger is used.

e, Elevation of a friction roller, round which the cable is wound as shown on the plan, three or four being used as marked, *e*.

d, Of the plan shows the compressor for stopping the cable.

h, The cable leading to the hawse hole. The method of bringing the cable to the capstan may be traced on the plan; the links shown in dotted lines being those in contact with the ribs (*gg*) of the elevation.

The merits of this plan consist in not requiring the intervention of a messenger, whereby the hands required for passing the nippers, which unite the cable and messenger when a messenger is used, are saved; but this method makes it necessary that the cable-locker, or compartment for the reception of the chain cable, should be immediately below the position of the capstan; an arrangement that is not always convenient in a man-of-war.

The windlass used in small vessels is a capstan, with the barrel worked horizontally, the power being applied by levers, which are shipped or worked in holes similar to those in the capstan head.

The American Capstan. Plate 71, A, represents the American capstan, the lower rim being fitted with sockets to take the links of the chain cable directly without the use of a messenger.

CHAPTER XV.

GROUND TACKLE—(Continued).

HEMP AND CHAIN MESSENGERS—NIPPERS—STOPPERS—HEAVING THE ANCHOR UP TO THE BOWS—CAT AND FISH GEAR—BUOYS—BUOY ROPES.

The Hemp Messenger, used for heaving in the cable, is a cable-laid rope, of the same size as the stream-cable, or five eighths of the working cable; in length it should be three times the distance from the capstan to the hawse-hole, having in each end an eye for lashing together.

To Pass the Hemp Messenger. If it is the intention to "bring to" on the port cable first, the end of the messenger is passed up on the port side of the deck, taken aft, and passed around the capstan with three turns, and the end taken forward as far as the main hatch; that part of the messenger which brings in the cable, or rather that upon which the capstan directly acts, forming the lower turn around the capstan. The other end of the messenger is, in the mean time, taken forward on the port side of the deck, passed around the roller under the bowsprit, and taken aft on the starboard side to the main hatch; where the two ends are lashed together, thus:

In one of the eyes is spliced the lashing, which is passed alternately through each eye in a figure-of-eight form, each part crossing the one adjoining it—the eyes being kept one and a half fathoms apart; the end of the lashing is secured by seizings; the slack of the messenger is then hauled around on the starboard side of the deck, bringing that on the port side taut between the capstan and roller.

To Dip the Messenger. After heaving in one cable, it becomes necessary to reverse the turns around the capstan, that the lower one may be convenient for heaving in the other cable. It is only necessary to unlash the eyes, slack the turns around the capstan, and pass the lower end up, or the upper end down (whichever may be most convenient), through the turns; after which, haul taut the turns around the capstan, and lash the eyes as before.

Nippers, by which the messenger is secured to the cable, are formed of yarns marled together like selvagees, or of foxes laid up after the manner of a coach-whip; the former are of more general use; they are about four fathoms in length.

PLATE 72

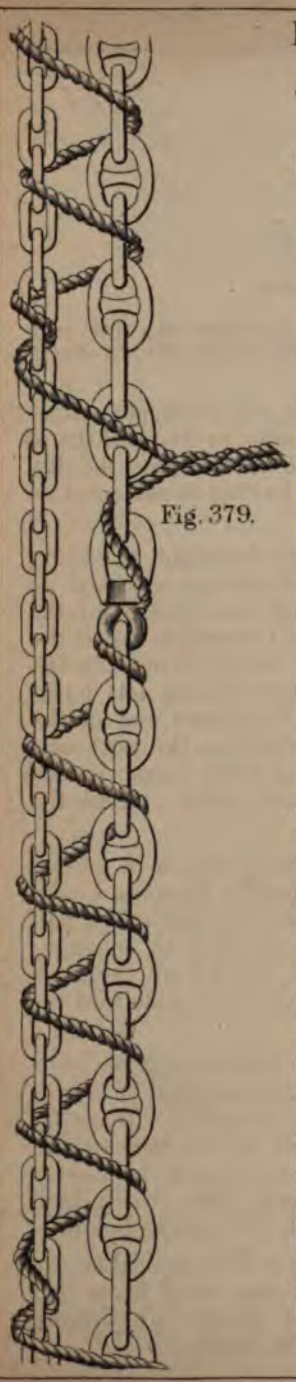


Fig. 379.

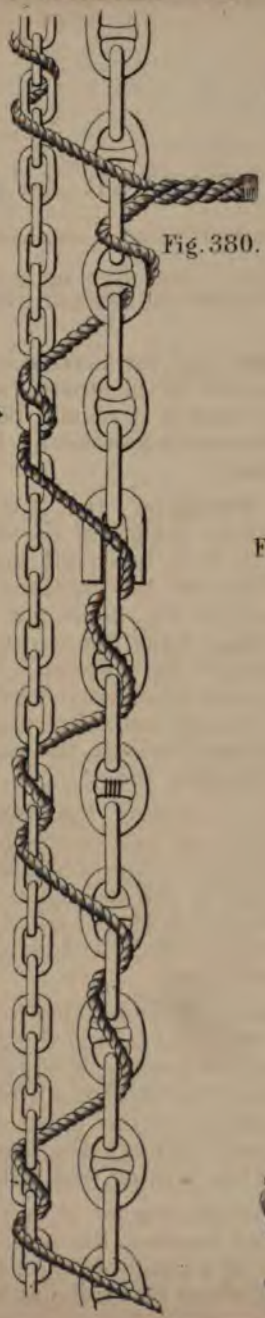


Fig. 380.

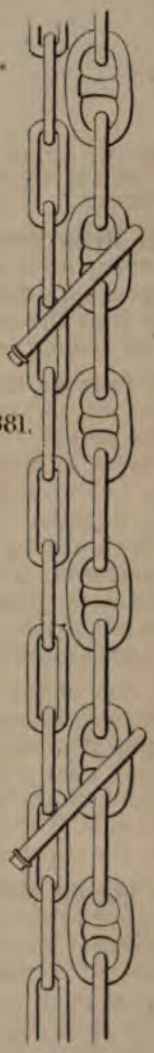


Fig. 381.

NIPPERS.

Passing the Nippers. If in light weather, and only to heave in the slack of the cable, or heave short, a round turn is taken on the messenger with the after end, and the remainder of the nipper is expended around the cable and messenger, against the sun; leaving end enough to twist up with the end of the next nearest nipper, Fig. 379, Plate 72, where a rope-nipper is represented.

When short apeak, or when blowing fresh, two round turns are taken with the after end around the messenger, and two with the forward end around the cable, twisting the ends up with the adjoining nippers as before, Fig. 380, Plate 72, and in heavy heaving, racking, or jambing, turns may be taken.

Hanging Nippers are much used in heavy heaving, and are found very useful owing to the facility with which they are applied or removed. They are selvagees of sufficient length to enclose the cable and messenger, and admit heavers to be thrust through their bights; which heavers are hove around until the nippers are taut. They may be also applied over the common long nipper, when the cable comes in covered with mud, to prevent the nippers from slipping.

Chain Messenger. With the improved capstan, Fig. 378, Plate 71, no messenger is required; but when it is impracticable to have this, the capstan may be made for a chain messenger, which will be found equal in every respect to the old hemp messenger. In connection with it iron nippers are used, Fig. 381, Plate 72. This messenger is in size two thirds of its cable. Its length is determined by circumstances.

The Iron Nippers are put on well forward by the manger, and are allowed to go aft to the fore-hatch, where a man is stationed (the armorer or his mate), who strikes the small link, *a*, with a hammer, knocking it up, when the nipper falls off, and is carried forward again by a nipper-boy.

The iron nipper has been tried with the hemp messenger, and found to work well. The opening in the upper part of the nipper is made round to fit the rope, and smoothed off so as not to injure it. For heavy heaving, besides the regular nippers—

Devil's Claws may be used with the iron or hemp messenger, and will be found very serviceable. They are fitted with hemp selvagee tails for dogging around the messenger, the claw being attached to the chain.

Stoppers. These are used for many purposes, but most generally for that of securing the cables in the tiers and on deck;

and as such, distinguished by names as various as their uses. Improvements, however, have been made in stoppers, and those used at the bitts, are now frequently fitted of chain, with a devil's claw, large enough to receive one of the links of the cable, over which it is placed, and retained by a small iron-pin, running through both parts of the claw. In the other extremity a slip-hook and ring are attached, by which it is secured to the stopper-bolts of the deck, Fig. 382, Plate 73. Its length is about four feet and a half, and in size depends upon the class of vessel for which it is required. This is designed to supersede the ordinary *deck-stopper*.

Stoppers with which to hold on, while hauling taut a brace, sheet, or other rope, are fitted with a hook and thimble at one end, or they are otherwise secured to eye or ring bolts near the rope for which they are required; from the other end to nearly the whole length they are formed as the dog-stopper. In using them, a half hitch is formed around the rope, which after the rope is hauled taut through it, is jambed, and the tail wormed along in the lay of the rope; this will hold it while being belayed.

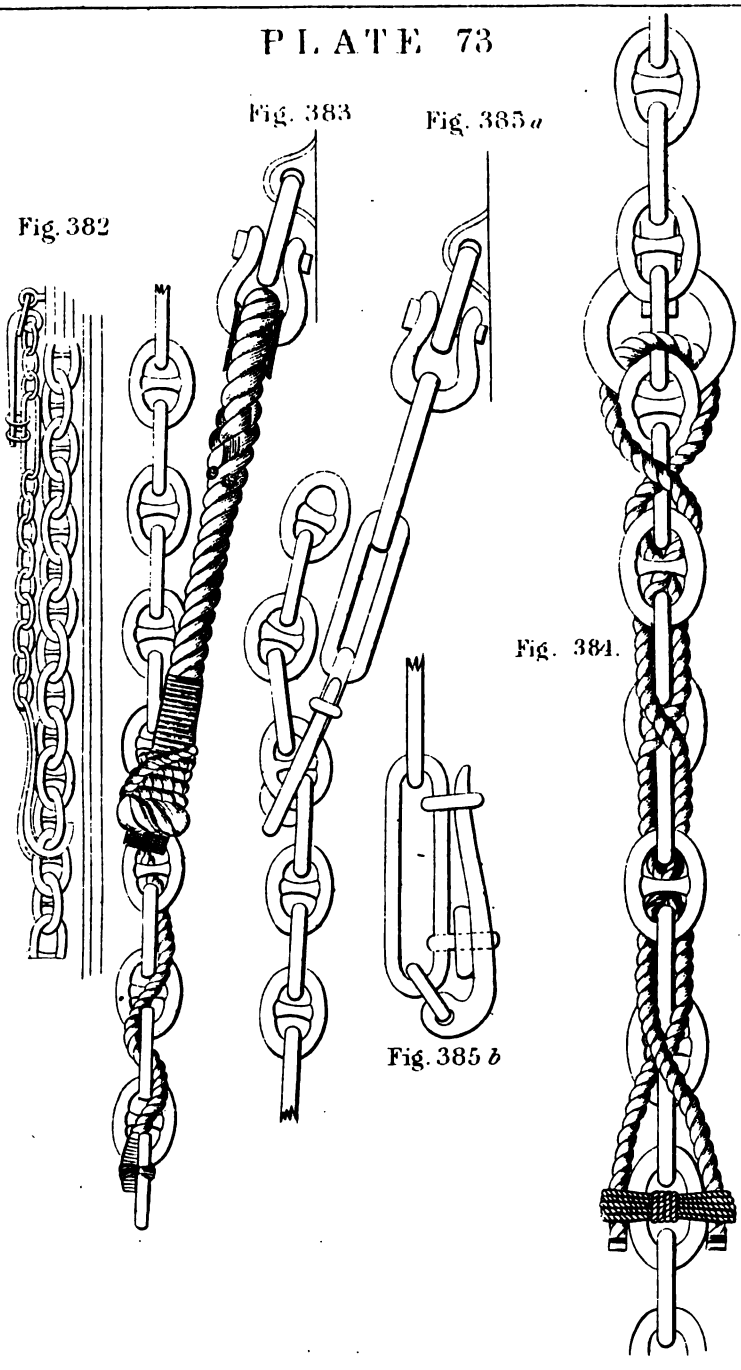
Stoppers, used for securing the cable, when at anchor, are the *deck*, *dog*, *ring*, *bitt*, and *hatch* stoppers, or compressors.

Deck-Stoppers, Fig. 383, Plate 73, are made of plain-laid rope, are one fathom in length, when fitted, and are in size, one half that of the cable on which they are applied. In one end is spliced a hook and thimble, or thimble alone, which is hooked or shackled to the stopper ring-bolts in the deck; in the other end is formed a double wall-and-crown, or stopper knot, with a laniard, one third the size of the stopper, attached with a running eye around the stopper close to the knot. The knotted end of the stopper is passed with the lay of the cable, and the laniard is passed against the sun, around the cable and stopper, with several turns—leaving a fathom of the end to worm forward in the lay of the cable; the end is then secured with a seizing.

Dog-Stoppers are four fifths the size of the cable on which they are used, and are from four to five fathoms in length. They are unlaid nearly their whole length from the ends, and are gradually tailed and marled after the manner of selvagees; or the yarns are laid up in foxes, and the tails formed of square sennit, or coach-whipped.

They assume different names, according to the purposes for which they are used, such as *bitt*, *wing*, or *hatch* stoppers; they are termed *bitt-stoppers* when used as bitts, *wing-stoppers* when secured to the knees in the wings of large vessels, in readiness

PLATE 73



THE COMPRESSOR.

to apply to the hemp cable when veering in heavy weather; and they are termed *hatch-stoppers* when used at the hatches for the same purpose.*

Ring-Stoppers are unlaid from the ends towards the centre, and worked up nipper-fashion; enough being left laid up in the centre to clove-hitch to the ring-bolts in the deck; being thus secured, one end is passed on each side of the cable, one worked into its lay, and the other passed across the first. Their length will depend upon the size of the cable. Fig. 384, Plate 73, represents a ring-stopper of plain-laid rope.

The Compressor having been carried away, to check a Cable while running out. This may be done by using ring-stoppers, Fig. 384. The two ends of the stopper are passed on different sides of the cable, forward through the ring-bolt, then dogged round the cable working forward, the two ends being knotted together when sufficient turns are passed; the bights are kept overhauled and triced up to the beams, the part abaft the ring-bolt by one stop and those before it by another; by letting go the foremost stop, the parts of the stopper catch the cable, and as they tauten break the after stop.

In the same way, you can veer through the laniard of a deck-stopper.

Iron-stoppers or Compressors in the corners of the hatch, and even at the bitts, are used. Those at the hatch are much approved of, on account of the certainty with which they check the cable, and the facility in using them; the great objection to using them at the bitts is, that they are often obstacles in the way of bitting the cable with despatch, and that they weaken the cross-piece. These iron-stoppers have entirely done away with the use of the wing and hatch stoppers, and by their use the dog-stoppers at the bitts are rarely ever needed.

Iron-stoppers or compressors are of various kinds. The oldest and best-known pattern is that of the curved iron arm, one end of which works on a pivot-bolt, so as to permit the curve to sweep the lower orifice of the chain-pipe. The other extremity has an eye formed in it, to which is hooked a small tackle. When veering, if the order is given to *haul to the compressor*, the tackle is hauled upon by the men stationed there, and the chain is compressed by the iron arm against the forward (or aft, as it may be rigged) side of the chain-pipe. Another and very effective compressor, which is quite common on board the new ships, is represented at *d d*, Fig. 378, Plate 71.

* These stoppers apply to hemp cables.

TO WEIGH ANCHOR.

The Slip-stopper, Fig. 385 (a and b), Plate 73. This is fitted with a crane-hook and shackle, and is found very convenient when working cables, as in clearing hawse, surging, &c.

Mix's Stopper consists of an iron casting like a hawse-pipe set in a strong oak frame-work on the after part of the manger. A thick and strong slab of iron, scored out on the under part to admit a vertical link of the chain, moves up and down in a groove, in the after part of the frame-work, by means of a screw placed vertically over it. This stopper is exceedingly convenient, and is much used; but the ship is never allowed to ride by it.

Fighting Stoppers. Though not belonging to this portion of the work, still, while on the subject of stoppers, it may be as well to mention here *fighting-stoppers*. These are kept at hand, ready for use at any time, particularly when going into action. They consist of a pair of dead eyes or bulls-eyes, rope-strapped with selvagee tails, and a laniard rove, Fig. 386, Plate 74.

To Heave up the Anchor. The messenger being passed, capstan bars shipped and swifted, and the messenger "*brought to*" on the port cable, proceed to heave the anchor up to the bows.

Man the bars! Heave taut! Take off the stoppers, unbit the cable, and *Heave round!* As the cable comes in at the hawse-hole, the nippers are passed, the men, holding on to their twisted ends, and to the heavers in the hanging-nippers, walk aft with them as far as the after part of the fore-hatch. There they are taken off and passed forward again. When there is much mud on the cable, it is necessary to use a quantity of sand on the nippers to make them hold, and also on the deck to prevent the men from slipping.

By the capstan, on the port side, are quarter-gunners with heavers, to fleet up the turns of the messenger around the capstan, and prevent that part which approaches the capstan from overlaying; on the starboard side are men stationed, to hold on to that part of the messenger which leaves the capstan, to keep the turns taut; they are seated on the deck, facing aft, and hold on as it passes through their hands. Others are stationed forward to light it around the roller and keep it clear.

The cable, as it comes in, is either paid below (after being cleansed) or ranged on the deck ready for running.

When a vessel has two anchors down, in heaving in on one cable it becomes necessary to "veer to" on the other. To do this, if the veering cable is the weather one, and in a stiff breeze, you will veer around the bitts, having taken off the forward deck-stoppers, and slacking the laniards of those abaft the bitts,

the cable being roused out of the tier as it goes out, or being previously ranged on the deck.

But if the veering cable be the lee one, it may be previously unbitted, and veered from the locker.

If, owing to the quantity of mud on the messenger, it does not hold on at the capstan, it may be necessary to use a tackle on that part which leaves the capstan. This is rarely the case, and only in heavy heaving.

When all the slack cable is hove in and the chain leads right up and down from the hawse-hole to the anchor, the officer of the forecastle reports, *Up and down, sir!* When not quite up and down, if circumstances seem to require it, he may report, *Short stay, sir!*

A cable is said to *grow* in a certain direction: thus the cable "grows broad off the starboard bow;" and when this occurs so as to make a short nip of the chain, and cause a heavy heave, it should be reported, as a change of the wheel, or in the disposition of the sail, or a turn back with the engine (as when on a windward tide the ship has overrun her chain), may bring it to grow right ahead and ease the strain on the messenger.

As soon as the stock becomes visible, it is very common to report the *Anchor in sight!*

And when it is up high enough for catting—*The anchor is up, sir!* Or direct the boatswain to pipe, *Belay!* The order from the quarter-deck will then be, *Hook the cat!*

The cat having been previously overhauled down, the block is hooked to the ring of the anchor by a hand on the stock aided by the cat-back. When hooked, set well taut on the cat-fall, and caution them on the gun-deck to be ready for surging the chain; then report, *All hooked with the cat!* or, *All ready with the cat!* As soon as this is made known, the order is given, *Haul taut! Walk away with the cat!* The chain or messenger is surged, and the anchor walked up to the cat-head; at the proper time the boatswain pipes belay, when the order is given to *Hook the fish!* As soon as the cat is up the ring-stopper is passed. When the fish is reported, *Haul taut! Walk away with the fish!* and when the fish is belayed, pass the shank painter.

Surging the Chain. When, as very frequently occurs on heaving in, the chain comes in muddy, it must be ranged on deck instead of paying it below in the lockers; thus fifteen, twenty or more fathoms of chain may accumulate on the deck. Now when the order is given to *surge*, the Mix-stopper (if used) is screwed up and the anchor swings to the cat. Should the cat

part at this time, or other similar accident happen, the anchor goes down, carrying with it the entire range of chain; and if on board a steamer she may, by that time, be going ahead under a "full head" of steam. Using a hemp messenger, it is safe to keep the nippers on and surge the *messenger*, by rendering it around the capstan. But should the Mix-stopper hold the chain, before screwing up, clap a stopper on the chain, allowing a fathom or so of slack for the cat, and for this purpose an iron nipper securing the cable to a ring-bolt, or a slip-stopper is very convenient. This precaution insures you against accident, and very little practice serves to enable one to stopper at the proper link to give slack chain enough to allow the anchor to go to the cat-head.

Cat-Falls. Begin with the *standing* part and reeve the end down through the forward sheave of the cat-head, through the forward sheave of the cat-block, placed so that the bill of the hook will point inboard, and so continue to rove full, when timber-hitch the end around the cat-head. In large ships it is found convenient to place the block in the bridle port for reeving the fall, after which round it up and trice back the hook, if not wanted immediately.

Cat-Backs are temporary, and for the purpose of facilitating the hooking of the cat. A small rope is rove through a block tailed on to one of the fore-tack bumpin stays, or an eye-bolt conveniently placed over the bows, and bent to a small eye-bolt or span on the forward cheek of the cat-block, the fall leading inboard. Another one may be bent to the back of the hook. With the assistance of these, the cat is hooked.

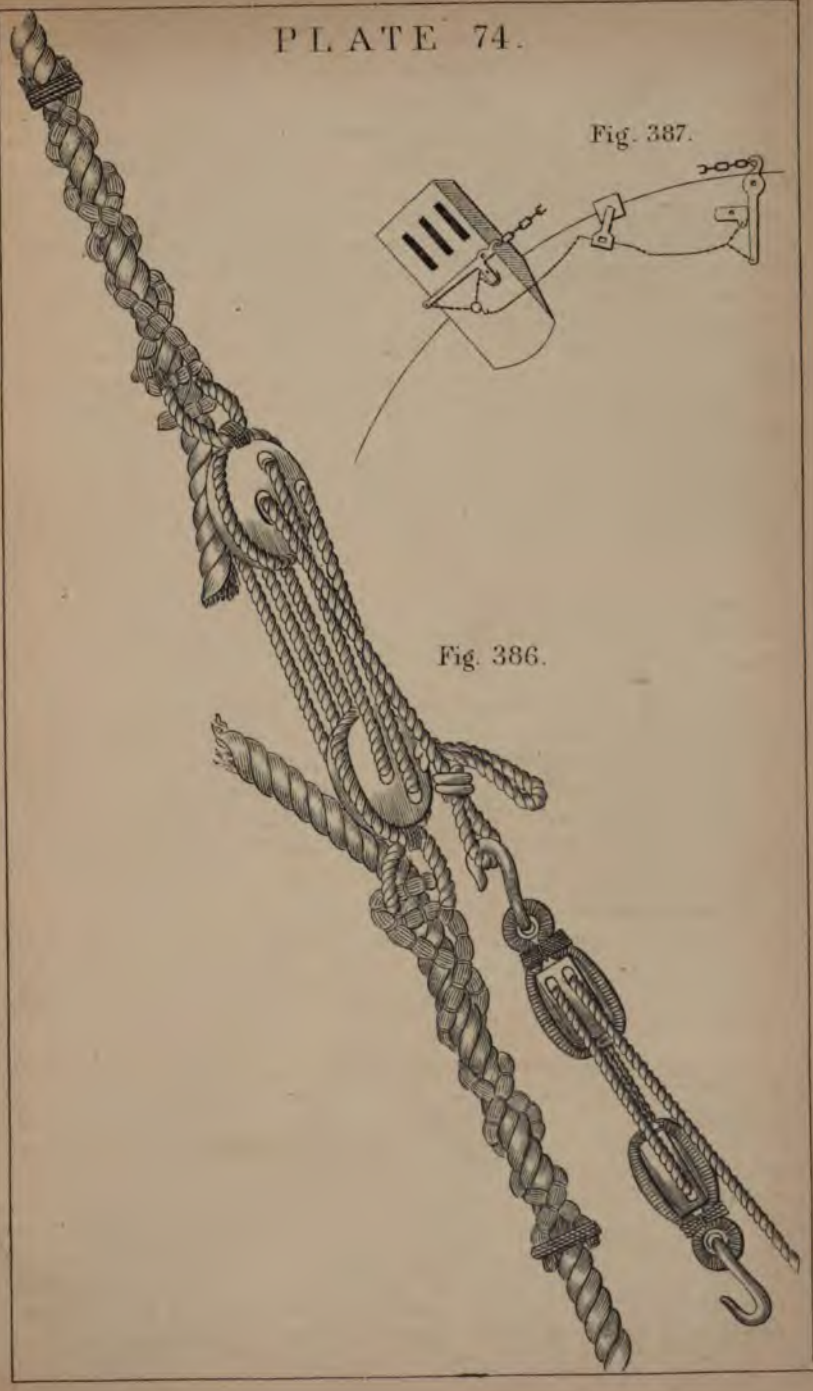
A Fish Back is for the same purpose, and may be bent to a small thimble grafted to the hook. A very good cat-block has recently been invented, having the hook so contrived that the anchor may be let go from it directly, without waiting to pass the ring-stopper, and unhook.

Cat-Head and Shank-Stoppers. Fig. 387, Plate 74, will serve to illustrate the manner in which both the ring-stopper and shank-painter are cast off simultaneously. The former, which is of chain, secured by a stout shackle to the forward side of the cat-head, is passed through the ring of the anchor (when catted), and the last link placed over a hinged-shoulder, maintained in an upright position by means of a hook-lever extending across the cat-head. The shank-painter is secured in a similar manner at the bill-port. To each of these a trigger is attached, fitted with a small chain leading in the water-way to the arms of a swivel, worked by means of a bar shipped in the mortise *c*, giving it a

PLATE 74.

Fig. 387.

Fig. 386.



half turn, either to the right or left, which disengages both stoppers at the same instant.

The plan hitherto has been, to have the shank and ring-stoppers of rope and chain, simply taken over cleats or cavils, and let go by hand, at the conclusion of the words "one—two—*three!*" Subsequently, this was modified by the introduction of the triggers, which were (and are now in many vessels) set off by means of a top-mall, and a hand at each.

Fish-Davits. The old-fashioned fish-davit for a sloop-of-war, is the simplest and best of all, and davits contrived on that principle are the best. For at the commencement of the operation of fishing, they rig well out beyond the ship's side, taking the anchor up clear, and when the inner fluke is high enough, the heel-rope enables it to be eased in on the bill-board to exactly where it is wanted.

The most approved plan now for large ships is to have a boom which attaches to the foremast by means of a goose-neck. This boom is variously rigged, as Fig. 388, Plate 75, for example, where *a* is the "in-and-out" jigger, by means of which the anchor is eased in on the bill-board; *b* is the topping-lift; *c* is one of two guys, the other hooking on the opposite side. The upper block of the "fish" hooks to one of the mast-head pendants as usual, the lower block hooking to the fish-pendant *d*, which, by the old rule, should be one third the size of the cable. In the lower end of the pendant is spliced the large fish-hook, and in the other is spliced a stout thimble.

A pendant-tackle is generally used for the fish. Sometimes it consists of a twofold purchase kept for the purpose.

The rigging of Fig. 388 might be still further simplified, and the sheave dispensed with, which would give the boom its original strength.

The old-fashioned davit, alluded to above, is simply a long spar with an open sheave in either end, at right angles to each other Over the outer end the fish-pendant passes, and over the inner end the heel-rope, which is rove as follows:—The davit being laid across the forecastle, one end projecting over the bill-board, the end of the heel-rope is secured to an eye-bolt just forward of it, passed aft over the davit, rove through a ring-bolt placed near for the purpose, thence through the inner sheave and a jigger clapped on; by passing the rope over it, the davit is prevented from rising when the strain comes on, and the jigger on the heel-rope enables you to work it in or out at pleasure.

By this purchase (the fish) the flukes of the anchor are raised until up to the gunwale, when the *shank-painter* is passed; this is made partly of chain, so that, when passed, the chain shall enclose the shank, while the end, which is of rope, is belayed around its pin. The shank-painter being secured, the purchase is unrigged, the fish-davit taken inboard, and the anchor now hangs by the cat-stopper and shank-painter.

In securing the anchor for sea, the flukes are raised to rest on the gunwale, and securely lashed; and additional lashings passed through the ring and over the cat-head.

And in preparing to anchor, after the cable is bent the lashings are taken off, the flukes cleared of the gunwale, and the anchor hangs by the cat and fish as before; this is termed "*getting the anchor off the bows.*"

And if the shank-painter is eased off so that the anchor hangs by the ring-stopper, it is then said to be *cock-billed*. It was the custom formerly to cock-bill the anchor before letting it go.

Buoys, Buoy-ropes. Buoys, attached by their buoy-ropes to the crown of the anchor, float on the surface of the water, and point out at all times, the situation of the anchor. The *can* buoy is in the form of a cone, the base floats uppermost and the buoy-rope is attached to the apex. The *nut* or *nun* buoy is largest in the centre, tapering off towards each end. The latter is in general use.

The size of *buoy-ropes* is one third of the cable. The length varies, for it is shortened or lengthened according to the depth of the water in which you will drop the anchor.

It is bent to the crown of the anchor, by taking a half-hitch around one arm, and putting the running eye in its end over the other arm; or a clove-hitch is formed over the crown, and the end stopped along the shank, or to its own part.

The buoy-rope is sometimes used for the purpose of weighing the anchor, when the cable may have parted; for which reason it is of the size previously mentioned. The most approved way of fitting it, to answer this purpose, and to avoid the inconvenience of so heavy a rope in ordinary cases, is as follows:—

Attach a large thimble to the crown of the anchor, by a stout strap of the size of the buoy-rope (one third the cable). Through this thimble is rove the buoy-rope, both parts leading up to the buoy. The advantage of this is, that the buoy-rope may be smaller, and when necessary, a stout rope of the required size, may be, by it, rove through this thimble in the crown of the

PLATE 75

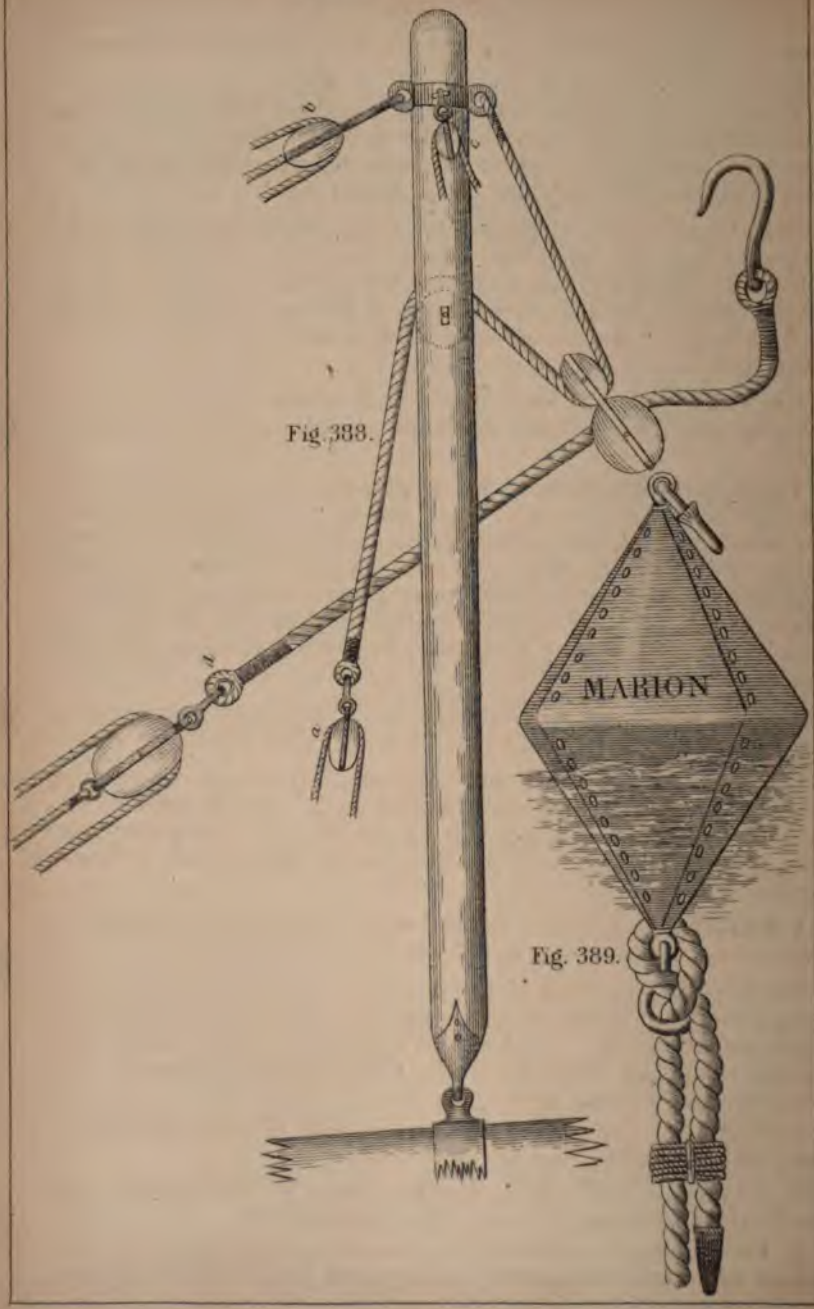


Fig. 388.

Fig. 389.

anchor thereby affording a greater purchase than that of a single rope, for weighing.

The only objection to this plan is, that the two parts of the small buoy-rope will become *hawser-laid*, and will not unreeve. But this may be, in a great measure, remedied by having one part plain-laid and the other back-handed rope.

Sometimes a buoy will not *watch*, from its having filled with water, or from the buoy-rope being too short, particularly in a tide-way. By this is meant, that it does not float on the surface of the water. In the former case it will be necessary to *bleed* it, that is, to let the water out. In the latter, to lengthen the buoy-rope.

Buoys are generally kept, one in each of the fore channels for common use. Spare ones are kept rigged and stowed in the hold.

The order to let go an anchor is immediately preceded by the command, *Stream the buoy!* But buoys have caused so much trouble by getting foul, either of the anchor or the chain, or by being overrun by the ship when anchoring with headway on, that it is thought best not to let the buoy go until the buoy-rope tautens and takes it. Or the man stationed at it may let it go as soon as the rope begins to tauten, then it cannot foul, and will watch properly.

The old rope-strapped wooden buoy has been, in a great measure, supplanted by the iron buoy, Fig. 389, Plate 75.

It was a very good rule, and one invariably observed by many of our oldest and best seamen, that an anchor should *never* be let go without a buoy attached. But since the screw propeller has been introduced, they have been less used, through fear of fouling the screw.

A Bull-Rope is a hawser led through a block on the bowsprit-end and bent to the buoy to keep it clear of the stem.

NOTE.—The old style of fish-davit for frigates, consisted of a perpendicular spar temporarily stepped in a saucer, immediately abaft the bill-board. It was rigged with hemp straps, but an iron shoulder-band, as on the boom, Fig. 388, may be substituted. It requires the following rigging:—

1. Fair leader, consisting of a stout single block at the davit-head for the hauling part of the fish-fall.

2. Guys, one forward, leading to a cleat on the cat-tail, and one leading aft to an eye-bolt in the fore-channels.

3. Fish-purchase, consisting of a double and a single block, the former fitted with a fish-hook—a large iron hook like that for the

FISH-DAVIT.

cat. The single block formerly was fitted with a strap to go over the davit-head, but may hook to an eye in the shoulder-band; the fall leads up through the leading-block at the davit-head, and is black-walled to the hook of the lower block of the fore pendant tackle.

4. Topping-lift, a small but stout jigger (used to cant the davit inboard or outboard), hooked to an eye on the upper end and to a strap around the foremast some distance above the deck.

5. Bill-tackle, from davit-head to ring-bolt in bill-port, as a sort of martingale.

6. After-tackle, a jigger also from davit-head to an eye-bolt in the deck at the partners of the foremast.

There are some good points about this davit, and it has been very successfully combined with the modern fish-boom. For instance, the fish-purchase (§ 3) has been placed on such a boom as in Fig. 388, in which case the sheave in the boom is avoided, though a thwartship jigger must be used to get the anchor on the bill-board.

It was to such a davit that allusion was made in the plan for purchasing a sheet-anchor without using the lower yards, for which it is well adapted by reason of the facility with which it may be handled, its security, &c., and if there is no good place at hand for stepping it, one may readily be contrived with cleats.

CHAPTER XVI.

ORGANIZATION.

On going into commission, the proper and early organization of officers and crew is a subject of the first consideration, and one which calls for the earnest and exclusive attention of the executive officer, upon whom this duty principally devolves.

That the machinery of a man-of-war, when once put in motion, may work harmoniously, it should be perfected to its minutest detail. A little well-directed industry at the outset, may save a wilderness of subsequent trouble and confusion.

After perfecting all details, it is essential that the executive should be *methodical* in conducting the duties of the ship—a want of system on his part may neutralize the most carefully-matured organization.

There is one rule which should be invariable, namely: that he, the executive officer, should be "up and doing" every morning, by daylight.

Daily, weekly, and monthly routines are established in many ships for the express purpose of securing a regular system of carrying on duties, drills, and exercises.

Besides organization proper, there are certain other matters which may be classed under the same general head, and which belong to every well-ordered ship.

Cleanliness, for example, is absolutely indispensable, and as it bears directly upon health, should receive every attention.

Lord Collingwood says, in one of his letters, "I have been long at sea. . . . . Yet, with all this sea-work, never getting fresh beef nor a vegetable, I have not one sick man in my ship." And his memoirist adds: "Lord Collingwood carried his system of arrangement and care to such a degree of perfection, that perhaps no society in the world, of equal extent, was so healthy as the crew of his flag-ship. She had usually eight hundred men; was, on one occasion, more than a year and a half without going into port, and during the whole of that time never had more than six, and generally only four on her sick list. This result was occasioned by his attention to dryness (for he rarely permitted washing between decks), to the frequent ventilation of

the hammocks and clothes, to the creating of as much circulation of air below as possible, to the diet and amusement of the men; but above all, by the contented spirits of the sailors, who loved their commander as their protector and friend, well assured that at his hands they would ever receive justice and kindness, and that of their own comforts he was more jealous than of his own."

These few sentences contain a fund of good advice, and are commended to the attention of those destined to command our ships.

Silence is one of the evidences of good discipline, and the crew soon acquire the habit, if properly instructed by the precept and example of the officers. Hailing the deck from aloft, giving orders in an unnecessarily loud tone, and useless repetitions of commands, should not be tolerated.

"Hark! the boatswain rudely bawling,"

is no poetic license in some ships, while in others the "pipe" is used almost exclusively to the great saving of noise.

The pipe to meals consists of three distinct parts; for "turning to," the same may be used omitting the middle part. This change alone saves the voices of the boatswain and his mates three times every day, and is certainly preferable to the old method.

Calls for hammocks and for boats may be made up from the following and their combinations:

The pipe of attention, used by the boatswain to summon his mates.
The pipe to haul.
" " " belay.
" " " heave around.
" " " veer, which may be repeated one or more times.
" " for side boys.
" " down.*

An improvement in calling the crew on extraordinary occasions, when the voice is used, may be made by dropping the "*All hands,*" and calling out distinctly what is required, as "*Reef topsails!*" &c.

Alacrity is another essential; a crew should be habituated as early as possible, to move smartly about the decks. When all hands are summoned on deck, they should go up the ladders on the run. The old rule for attaining this desirable end, was found in the *ratan*, carried by the boatswain and master-at-arms.

* The drum and bugle may also be used for calls and signals.

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In respect to internal organization, the French men-of-war are probably not excelled by those of any other nation. Their *mode de numérotage* seems to leave little to be desired for stationing a crew. The watch-bill may be said to be the key to our system of stations—the quarter-bill of theirs.

"It is said to be no unusual performance for a French line-of-battle ship, not six months in commission, to heave in ninety fathoms of chain and make all sail within fourteen minutes from the appearance of the signal to 'get underway.' A topsail will be shifted in little more than seven minutes and a half, and a whole squadron have been known in a gale, with a heavy sea running, to strike top-gallant masts in nine minutes. A screw line-of-battle ship—the *Brétagne*, was observed to single-reef her topsails in rather less than two minutes and twenty-five seconds."*

Such expedition is very becoming to a man-of-war, and is attained first, by carefully stationing the crew; and secondly, by regular and systematic exercises.

Organization includes the Berthing, Messing, Watching, Quartering, and Stationing of the crew.

Berthing requires the earliest attention, and the operation may be facilitated by having a plan of the decks, showing the hammock-hooks of every available berth. The watches should be distributed equally on each side of the ship, so that when one watch is piped up the other will not be left entirely on one side. Boatswain's mates and men liable to a call at any time of the night, should be placed near the hatchways; quartermasters, marines, and others who keep watch and sleep in, in the morning, placed where they will not be disturbed after all hands are called. At least one boat's crew should be so berthed that they can be called at a moment's notice.

The boys of the ship must be berthed together and separate from the rest of the crew.

On a tack over the forward hammock-hook of each billet is hung the number, corresponding to the hammock, neatly painted on a small tin plate.

Hammocks. The hammock numbers correspond to the watch numbers, the odd, such as 1, 3, 5, 7, &c., for the starboard, the even, as 2, 4, 6, &c., for the port watch; and in quartering the crew, all the starboard watch are to be distributed among the odd-numbered guns, the port watch among the even, presuming that the force and intelligence of the crew are equally divided, so

* "The Navies of the World," by Hans Busk.

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that in preparing for action at night at least half the battery may be fully manned, while the watch below are bringing up and stowing the hammocks.

On each hammock should be sewed the owner's watch number, neatly painted on a piece of canvas, cut in a regular and symmetrical form.

Hammocks are lashed up by taking seven marling turns with a Manilla, or white rope (untarred hemp) lashing. "Tie-ties" are now preferred to lashings, as the hammock can be tied quicker than lashed; they do not wear out the hammock as a lashing does, and are much neater. Every hammock should have three good nettle stops on the head, for stopping on the girtlines, and two on the foot. Some officers prefer having the stops put on the girtlines.

As hammock-girtlines are usually fitted to trice up alongside the masts, the rule for stopping on hammocks is with the numbers "up and out."

As this rule is made for convenience alone, of course any change in the manner of tricing up girtlines would change the rule.

A regular station-bill for stopping on hammocks, especially on board large ships, conduces to order and saves time and annoyance.

Bedding may be effectually aired in port, by stopping it on the hammock girtlines by the station-bill, thus securing more system than by the usual method.

A complete set of clean hammocks should always be on hand. After scrubbing, they are turned in by guns' crews, each one carefully inspected by the officers of the divisions, to ascertain if they have been properly scrubbed, &c., rolled up, placed in a bag or case having the gun's number painted on it, and taken to the sail-room where the sailmaker receives it. A torn or badly stained hammock should be left out and given to the sailmaker's mate, to be exchanged.

Hammocks stow in their own parts of the ship; a gauge to level them at the right height above the rail, and a hoop through which they are required to pass, being sometimes used.

On board large ships, when hammocks are piped down, the junior officers should be required to attend to preserve order.

Each man should be required to have at least one mattress-cover.

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Seamen sometimes have the habit of keeping their oil-skin jackets or hats in their hammocks. This should be strictly prohibited.

Bags. Bags should be marked with his "ship's number," so that when a man is shifted from one part of the ship to another, his hammock number alone is changed.

The arrangements for stowing bags should engage the serious attention of the executive officer, for on it depends much of the comfort and health of the crew. The principal points to keep in view being facility to get at them at any time, for the purpose of shifting in dry, working, or mustering clothes; stowed so that any one bag can be readily obtained; to present a uniform and neat appearance, and to be measurably secure from theft.

The crew are expected to dress for the day during the breakfast hour. It has been found very convenient to have a board arranged with slips, on each one of which is painted the name of an article of uniform, as "white frocks," "blue trousers," &c., and the slips arranged as the uniform for the day requires. The slips being properly arranged, the board is hung in some conspicuous part of the ship, as at the main-hatch, scuttle-butt, &c.

Before "quarters for inspection," the bags should be neatly stowed, and not touched again until supper, when the crew shift in blue woollen clothes for the night. As a general rule, no one is allowed to have his bag out of the regular time but by permission of the officer of the deck.

The men should be allowed to have their bags at least once a week, for the purpose of overhauling, mending, marking, and airing their clothes. Saturday afternoon is generally devoted to this. When circumstances admit, bags are piped up twice a week, and Wednesday given for the same purpose. The men should also be allowed their bags as soon after serving out clothing as possible, that each new piece may be marked, altered, &c., before stowing away. If the crew are not allowed frequent access to their clothes, they cannot be expected to keep them in good order.

Ditty-Bags contribute much to the comfort of the men, and should be allowed. That they may not become a nuisance, they should be made of prescribed dimensions, and a definite place assigned for their stowage.

Ditty-*boxes* are inadmissible.

Clothing. Each piece should be distinctly marked with the owner's name and ship's number. *Working clothes* have no recog-

nized existence. If every man was required to have a couple of jumpers and a pair of overalls made of strong cotton-stuff, like Kentucky jean, or denim, they would work with greater freedom, and save their more expensive clothing.

Pea-Jacket Bags, one for each part of the ship, have been found very useful. They should be distinctly marked, and a place assigned for them.

"A place for everything and everything in its place," is a rule particularly applicable to a man-of-war.

Messing. The crew is divided into messes of twelve or fourteen members each, as may be found convenient. Each mess has its own cook appointed from among their number, whose duty it is to draw provisions, take care of the mess-traps, and clean the berth-deck. As a general rule, the members of each mess take it by turns to act as cook, week and week about.

Petty officers mess by themselves, and employ "steady cooks," that is, men of inferior rating, who, for certain considerations (generally their ration), take charge of the mess for an indefinite period.

Steady cooks are in some respects desirable; under a good master-at-arms they soon become thoroughly drilled in their duties—they keep their messes in good order, and the berth-deck dry and clean.

The Watch-Bill. Upon a judicious distribution of the physical force, and a proper arrangement of the men, depends greatly the facility with which evolutions may be performed. In filling important stations, such men are selected as by their long services and capacities are best suited to them. By ascertaining the length of time each man has been at sea, and in the service of the United States, the stations they held in the last vessel to which they belonged—being also governed in some measure by the general bearing, manner, and appearance of each—you will be enabled readily to appoint to them their proper stations, selecting the best, from among the seamen, for petty officers.

Both in watching and quartering a crew, they should be so stationed that they will find their general duties to be in some particular part of the vessel; for instance, a forecastle-man or foretop-man should be stationed, in all the evolutions, on or near the forecastle, and around the foremast, and quartered at one of the forward guns; the maintop-men, amidships; mizzen-top-men, after-guard, and marines, abaft; carpenters, in the vicinity of the pumps, and so on.

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A system of *partners* is also greatly conducive to regularity in the performance of duty—that is, having the men divided off in pairs, so that each man may know his partner, and be responsible for his station when he is absent from the vessel or deck. The partners should be stationed at the same gun, but on different sides—should have the same station in different watches; there should be but one in the same boat, and, if possible, the other should not belong to any boat; their hammocks should hang as nearly as possible together, and they should mess together; thus would they be united in a common feeling of support.

The petty officers, viz., boatswain's-mates, quarter-masters, quarter-gunners, captains of the forecastle and tops, are appointed from among those seamen whose characters and capacities have entitled them to advancement to these stations, where they are intrusted with much responsibility and authority, and are expected to set an example to the rest of the crew, in their general deportment and attention to their duties. There are other petty officers, as master-at-arms, ship's corporals, coxswains, ship's cook, stewards, &c.

On the forecastle are stationed able seamen—men acquainted with all the duties of a sailor—together with a few ordinary seamen, and landsmen.

In the tops are stationed seamen, ordinary seamen—active, able-bodied men—and a few boys of the first class to handle the light sails.

The Mastmen and captains of the after-guard should be elderly seamen—if there are any on board who are not petty officers—who, though incapable of performing the rough work of a forecastle or top, may fill these stations well.* The after-guard should be made up of a few seamen, ordinary seamen, and landsmen.

The mechanics, musicians, and servants, are generally watched in the after-guard.

Idlers are such as are not watched, having day duties to perform of a peculiar nature, such as master-at-arms, the yeoman who has charge of the store rooms, and keeps the expenditure book, cooks, officers' servants, &c. These men, though not required to keep a regular watch, should have stations allotted to them in all the evolutions.

* There is a difference of opinion in this respect, many thinking, with good reason, that mastmen should be young, active, and intelligent seamen.

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There are a number of officers in all vessels who are termed idlers, viz.: the captain or commander, first lieutenant or executive officer, navigator, paymaster, surgeon, marine officer, chaplain, clerks, and the midshipmen who are stationed on the lower decks. They keep no watch, but are on duty during the day.

The marines are always watched at sea, and perform duty on the quarter-deck with the after-guard.

A few of the smaller boys, who are not distributed among the tops to work the top-gallant and royal-yards, and hand the light sails, are stationed on the quarter-deck as *messengers*.

Stations for work aloft should be so arranged as to give each man about the same amount of canvas to handle; to do which, take the complement allowed the ship and deduct from it the officers, marines, idlers, and the remainder will be the number of working hands for the watch and station bills; from this number take the boatswains' mates, quarter-masters, &c., and distribute the remaining strength according to the canvas on the lower and topsail yards.

After the watch-bill is made out, having divided the men equally in two watches, starboard and port, the other station-bills for "tacking and wearing," "reefing and hoisting," "making and shortening sail," "mooring and unmooring," "getting under way," and "coming to anchor," &c,, are formed from it, taking care to have at each station an equal number of each watch, so that with but one watch on deck, the vessel may be worked and all stations manned; this divides the force, and you have an equal number of men on each side of the deck.

Boats' crews should be selected as soon as possible, particularly if the ship is lying in the stream, when their services will be in constant demand. They should be placed in charge of coxswains and taken from the different parts equally, so as not to weaken one part more than another.

While at sea there should be a full life-boat's crew in each watch, and in case a man falls overboard *they, and they only*, are to man the boat.

If it was the custom to call the watch at night ten or fifteen minutes *before* eight bells, detail all reliefs and the life-boat's crew; then there would always be on deck a full watch, wide awake and ready for work, and the ship, when under canvas in bad weather, not jeopardized twice every night—and there is no reason why such a system should not be introduced and strictly adhered to. This plan is especially recommended for adoption during the practice cruise.

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A station bill for holystoning and scrubbing decks is a very unusual thing, but it would be found very serviceable and insure the decks being more thoroughly and more expeditiously cleaned. For example, let certain men be detailed for the large stones, others for the small ones, to go around certain places; some for the ladders and coamings, others for the paint work; certain persons selected, whose duty it shall be to get up and return buckets; others to be responsible for the good order and cleanliness of the swabs, to wash and ring out, stop up to dry and stow them away, &c. In this way men will work to greater advantage and the decks can be well cleaned and dried in a seasonable time. It is not necessary to commit this to writing; but let the captain of each part tell off his men to their respective duties.

Quarter Bill. In selecting men for captains of guns, take those petty officers who are not appointed to more important stations, men long accustomed to the gun exercise on board ship—steady, trusty, and able-bodied, with good sight; after supplying the guns with first captains, proceed, upon the same principle, in selecting second captains from among the seamen; then the spongers and loaders, who shall be light, active men; shell men, handspike men, &c., in the order in which they are enumerated.

For the first division of boarders, will be wanted the most effective men; for sail-trimmers, men stationed on the spar deck; at the wheel, the best helmsman in the vessel; at the relieving tackles, an officer or quartermaster, with a few men to steer the vessel in case the wheel or tiller ropes are shot away. In the magazine is stationed the gunner and his mates, and the cooper. Select for the stations below, for passing powder, shot, &c., those men who would be least effective on deck, or least capable of acting promptly in the heat of action. Have in the master's division, to attend the stoppers and to remain in the tops, active topmen.

The first lieutenant, under the direction of the commander, works the batteries, while the navigator, under the direction of both, and assisted by the boatswain on the forecastle, attends to the manœuvres. The other lieutenants are stationed, one to command each division. The marines, under command of their officer, are in the waist, or on the poop, and often some are stationed in each top, to annoy the men at the enemy's guns. The midshipmen are distributed about in the tops, and at the divisions, to the best advantage.

In the *Ordnance Manual*, to which the student is referred, may be found the most carefully arranged quarter-bills, and full instructions for quartering a crew.

The stationing of a large crew is rendered comparatively easy by having blank forms of station bills. Keeping in view the

general principles laid down for selecting men, the watch-bill, being the key to all the rest, is first made out. This once satisfactorily arranged, the rest is plain sailing.

Under the present system, the men are kept on board the Receiving Ship until the vessel fitting out is so far advanced as to be ready to receive them. No pains should be spared to get a good master-at-arms and ship's cook.* The executive officer can have his crew mustered on board the Receiving Ship at pleasure, he therefore should lose no time in selecting his petty officers and making out the watch-bill, berthing and messing the crew. Mess cooks should be selected, and the master-at-arms and ship's cook should go on board to see if all the gally arrangements and mess-chests are complete. It is found convenient, as a general rule, to take the men from the Receiving Ship after dinner, as it is easier to have supper the first meal to be prepared on board their own ship. When the watch-bill is complete it will take a good clerk but a few hours to fill up the billets. If these are given to the men before leaving the Receiving Ship, they can shoulder their bags and hammocks, march on board their own ship, stow their hammocks in their proper netting, their bags in their own mess, and go to "general quarters" the next moment, if need be.

Blank forms of billets should be printed on strong paper, that the men may keep them in their caps without wearing out too soon.

FORM OF BILLET TO BE GIVEN EACH ONE OF THE CREW, BEFORE GOING INTO COMMISSION.

Watch. No. 2.	*Charles Anderson.* C. F. C.
Reefing	*Head bowlines.*
Tacking and Wearing	*F. C. Let go Head-bowlines. Let go and shorten in Fore Tack and belay it.*
Getting Underway	*Head-bowlines. Downhauls and Head-sheets.*
Anchoring	*Head-bowlines. Sheets and Tack. Downhauls.*
[illegible]	*F. Topmast Staysail.*
Furling	*Head-bowlines and Downhauls. Staysail.*
Bending Sails	*Clear away Jib-Stay. Reeve it. Hook Halliard's. Man downhaul. Hook lower block of sail Burton and Yard-arm whips.*
T. G. and Royal Yards	*F. T. Gallant Yard Rope.*
Mooring and Unmooring	*Fore Castle. Port.*
Quarters	*No. 8 Gun. 1st Capt. 2d Boarder.*
Boat	*Launch. Chief of Howitzer.*
Mess	*No. 2.*

* An executive officer will find it greatly to his interest to obtain, at almost any cost, a few good *assistants*. Besides getting a good master-at-arms, he should exert himself to procure a good painter, cooper, shoemaker, and most particularly a good fiddler.

DUTIES OF SEAMEN, ETC.

Watch. No. 76.	*Peter Brown.* (Sea) Main Top.
Reefing	*Main-topsail and Main-topsail Halliards.*
Tacking and Wearing	*Main Clew-Garnets, M. Tack.*
Getting Underway	*Loose Main-topsail.*
Anchoring	*Main-topsail Clewlines or Clew-jiggers. M. Brace.*
Loosing	*Main-topsail.*
Furling	*Main-topsail.*
Bending Sails	*Hook and overhaul Burton. Yard arm whip. Toggle Buntlines, &c. Topsail Yard to overhaul Rigging and get ready. Bend Topsail.*
T. G. and Royal Yards	*Main T. G. Yard Rope.*
Mooring and Unmooring	*Take off Nippers and range Cable.*
Quarters	*No. 8 Gun. 1st Loader, 2d Boarder.*
Boat	*3d Cutter.*
Mess	*No. 6.*

DUTIES OF MEN IN DIFFERENT PARTS OF THE SHIP.

Forecastle Men rig and unrig the bowsprit, jib-boom, flying-jib-boom, fore-mast, and fore-yard.

Bend and unbend, loose and furl the head-sails, fore-sail, lower, and topmast studding-sails.

Reeve and unreeve, overhaul and hook cat and fish; pass ring-stopper and shank-painter, lash cables for clearing hawse, and stow anchors.

Lash fore-runners and tackle; hook the top-tackle blocks to top-pendants and reeve fore-jeers.

Turn in fore-rigging, reeve laniards, set it up; spar and rattle it down; and set up futtock rigging.

Attend in lighters to sling stores, &c., and keep the upper deck clean from head to waist. Take the weather wheel.

Take the starboard lead when working with the watch.

Fore-top Men, reeve and unreeve top-pendant; fit and reeve all standing and running rigging above the top.

Bend, unbend, loose, reef, and furl fore-top sail, top-gallant sail, and royal; main top-mast and top-gallant stay-sails, set and take in fore-top-gallant studding-sail, and hook the burton for top-mast studding-sail.

Shift fore top-mast and top-gallant-mast, topsail, and top-gallant yards, and put whips on yards and stays. Set up top-mast and top-gallant and royal backstays.

Pass nippers when working the cables. Keep fore-top and fore-channels clean and in order, and clean port side of main deck. (Main-topmen clean starboard side.)

DUTIES OF SEAMEN, ETC.

The duties of fore and main-topmen are much the same in their respective tops. Working with the watch a main-topman takes the lead in the port-channels.

The peak of main-trysail belongs to the main-topman.

The Mizzen-topmen have nearly the same duties. They loose and furl the peak of the spanker; clean and keep in order the port-channels and port side of quarter-deck or poop.

The After-Guard have the care of the starboard side of quarter-deck and poop, and starboard mizzen channels.

Bend, unbend, loose, reef, furl, and shift the main-sail,* main-trysail, and spanker. Look out for the mizzen rigging and cross-jack yard.

The Quarter-Gunners rig and unrig main mast and main yard; turn in, set up, spar and rattle down main and futtock rigging.

Bend, unbend, loose, reef, and furl main sail, main-stay sail, and main-topmast studding sail; attend lower studding sail, out-haul and after-guy; the fore-topmast, studding-sail tack, and boom-brace, main tack, and sheet.

Reeve main-jeers, hook main-top tackles. Look out for sheet anchors and attend at capstan when heaving in.

Look out for battery, ordnance stores, and life-buoys.

Quarter-Masters being generally main-yard men work on main yard and in main rigging. To them belong everything appertaining to the sounding and steering gear, and signals.

At sea they always *con*† the ship, and attend at the heaving of the deep-sea lead and the log.

* This applies only to those of the after-guard who are stationed on the main yard.

† Con—from *conduire* to conduct. To direct the helmsman how to steer. WEBSTER.

CHAPTER XVII.

SPARE SPARS—PREPARING FOR SEA.

THE topmasts of large ships weigh between two and three tons, therefore in getting them in, the yards should be secured and the yard and stay-tackle used.

Hoisting in Spars. Overhaul down the fore and main-yard tackles, fore and main-stays, and lead their falls to the opposite side of the deck the spars come in at. Hook burtons to the lower caps (double blocks), single ones to selvagees around the lower yard arm, close inside the lifts. Send the falls on deck, and pull up the lifts and burtons together, brace the fore-yard in, and hook on to the spars. They should be always hoisted in as stowed.

For instance, those intended to be placed underneath, should be hoisted in first; such as topmasts, half-yards, and jib-boom, for the lower tier, and round off with the smaller spars on the top. See also, when hooking on, that the head is aft or forward as it is to be when stowed, as the difficulty of slueing them end for end, when on board, would be very great.

If the spars are too long to come in abreast, between the fore and main masts, such as topmasts, hook the main-stay to the strap round the foremast end; the fore-stay to the after one; then hook the yards to separate straps made of pieces of stout rope knotted together, or good selvagees, according to the weight of the spar. Man the yards and walk them up; when clear of the hammock-nettings, haul on the main-stay, ease the fore and main yards, keeping the spar square, and get the foremast end inside the rigging; then ease the main stay, and get the spar in its place on the gallows, skids, crane, or chocks, as the arrangement may be. Small spars can be got in with the main-yard; a double-whip on mainstay, or single guy if required.

Stowing Booms between the fore and mainmast. Sometimes booms are stowed in one pile with a nest of boats on either side, the topmast, however, always outside of all; or in two piles, one on each side and a nest of boats between.

In two Piles. The spars on the starboard side are stowed as follows, viz.: Main-topmast, head aft; stump main-topgallant-mast, mast-fishes, half-yard, and main-topmast studding-sail

SPARE SPARS.

booms, if used. On the port-side—fore-topmast, head forward; stump fore-topgallant-mast, mast-fish, half-yard, fore-topmast studding-sail booms, flying-jib-boom, &c. Some officers prefer stowing the main-topmast with the head forward; and there is good authority, though it is not practised, for stowing the fore-topmast with the head *aft*. The experiment, on being tried, proved that the ship having her fore-topmast stowed with its head aft, was the first to complete the operation of shifting topmasts. The heel of the topmast can be lifted by stay-tackles over the knight-heads, and boused forward by a fore-and-aft tackle from the bowsprit-cap. The difficulty only occurs when the length of the topmast is great in proportion to the height of the tressle-trees above the spar-deck.

There are numerous small spars which are equally divided, to make the booms as snug and neat as possible. A great deal of room can be gained by stowing them amidships in one pile, and the boats on each side. As the spars are stowed they should be *numbered on each end*, also a list taken, and painted on the fore-side of the boom-boards; by so doing it will save much time and trouble to find any spar that may be required.

The booms are lashed to span-shackles put in the deck for the purpose. A few small spars should be kept out, to drive under the lashing, to set all taut. When stowed, they are covered with tarpaulins, or matting made for the purpose. When the spars are all in, square the yards.

In lieu of one long lashing it is much better to have a strap fitted, and the bights of the strap, after passing it around the spars, lashed to the span-shackles; then there is but a short lashing to pass, cast off, or cut.

It is now the general practice, to stow *both topmasts with their heads forward;* and many ships stow all their spars amidships in one pile, with the exception of the fore and main topmasts, which are stowed outside of the boats; spare main-topsail-yard on the starboard-quarter, the fore on the port-quarter, in the chains or cranes, and spare jib-boom amidships or on the port side with its outer end forward.

Spare fore and main-topsail yards should be as completely rigged as possible. Top-gallant and royal-yards and studding-sail booms are easily replaced. A vessel may be saved from a lee-shore, by having a topsail or lower yard to supply readily the the place of one sprung, while the lighter yards may be of little use; though in case of chasing, or being chased by an enemy, topgallant-sails or studding-sails should not be spared for want of yards or booms. Spare spars should be at all times protected

PREPARING FOR SEA.

from weather, by having all cracks and openings chinched with cotton, and filled up with white lead, and the yards painted, and when in the cranes, should be well secured with stout lashings and covered where they may be exposed to chafes. Spare spars in the chains frequently cause the main-sheet to get foul, therefore there should be no lack of timenoguys on them.

A Timenoguy is any piece of rope placed to prevent rigging from chafing or fouling, such as that between the main rigging and the sheet-anchor stock, to keep the main tack and sheet clear of the hammocks, when working ship.

HINTS ON PREPARING A VESSEL FOR SEA.

In getting a vessel in readiness for sea, an officer should be particular that every precaution is taken to prepare her to meet any emergency; and in all the internal arrangements, as well as in the rigging, he should combine, as much as possible, neatness and economy with strength and usefulness.

He should see that the provisions, water, and stores of every description, are on board in compliance with the requisitions made out and approved, and that they are properly stowed in those parts of the hold, spirit-room, or store-rooms, where they belong; that the proper entries be made on the log, and on the books of the yeoman; that proper and capable persons are appointed to attend to, and account for their expenditures; that the store rooms are properly regulated, so that any article required may be instantly obtained; and that the rigging in the boatswain's store room may be so arranged, that the end of any sized rope may be, at any moment, passed up on deck. (It is a good arrangement to have a coil of each sized rope on reels, ready for instant use.) He should see, too, that the hawsers and tow-ropes are so stowed that their ends may be, at any moment, passed up, and at least two of them on reels.

That the masts are upright, well stayed and greased; head-booms well supported; yards square; lifts marked; heels of booms square, and toggled; ends equally rigged out; gaskets black, square and at equal distances; ropes coiled down clear for running, on deck, and flemished down snugly in the tops. The *ends* of all running rigging neatly hitched, or pointed; square and "sharp up" marks on all braces. New topsail halliards* well stretched and re-rove, that they may not become

* The lower block of topsail halliards should have a swivel hook, for clearing when cable laid.

cable-laid when making sail. Spare sails, preventer-braces; spare yards, parrels, brace-blocks, mast and yard covers, hammock girtline, and clothes-lines fitted. Stern-ladders in good order and fitted with life-lines. That ropes likely to unreeve in a squall, such as main and jib sheets, have an overhand knot in the end.

Besides the square marks on braces, it is well to have a mark on the jib and spanker sheets, as they are frequently trimmed unnecessarily flat.

That the sails bent are properly brought to the yards and gaffs; that every rope-band is well secured, and that the head and reef-earings are good, and all arrangements for reefing in thorough order. That the spare sails, properly fitted with rope-bands, bowline bridles, reef-tackle blocks, head and reef-earings, sheet and clew-line blocks, etc., are properly made up, tallied and stowed conveniently in the sail-room; that each studding-sail has its appropriate cover, and that all sail covers, boats' sails, wind-sails, awnings, hatch-covers, etc., are on board.

He should see that the laniards of the rigging are good, that the dead eyes and ends of the shrouds are square, and that the latter are properly capped. That the purchases, winding and rolling tackles, preventer-shrouds, storm-sails and gear, spare tiller, relieving tackles, etc., are fitted and at hand. That the running rigging all leads fair, and that mats, raw hide, scotchmen, and timenoguys, are placed about the rigging and yards, wherever they may prevent chafes and fouling. He should see that the ratlines of the lower and topmast rigging are trustworthy and square, and that defective ones are instantly replaced by new; so that the sailors may go aloft fearlessly, and with confidence. That each top is supplied with a top-maul, secured by a laniard; and a small top-chest to contain marlinspikes, stoppers, jiggers, etc. That stoppers are prepared and ready to be applied to the braces, sheets, halliards, etc., wherever they are belayed; and that the captains of the forecastle, masts, and tops, have always at hand jiggers to be applied to any rope when necessary. That chain slings for the yards and gaffs are properly fitted, and at hand for instant use.

After the boats are in, he should see that they are properly stowed, and that they, the galley, spare spars, anchors, and everything that may be affected by the rolling and pitching of the vessel, are well secured. That there are stretchers in all the boats, and that one of the quarter or stern boats is always kept in readiness to be lowered at short notice. That the plugs of the boats are secured near the plug hole by a good laniard, and a line from well forward in the forechains secured to the ring-bolt in

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the bows. That at least one of the outside boats is fitted with a lowering apparatus, and that each one has a breaker of water and their gripes fitted with slips. That the fittings of all boats are thorough for any service. That the life-buoy is properly hung, with a hatchet becketed near to cut it adrift. Or that the trigger for letting it go is in perfect order, and the port fire and lock are so arranged that the ignition of the former will not be doubtful, making one or two trials with it if necessary. That there is an axe or hatchet always kept at each mast, secured in beckets.

He should see, previous to sailing, that the rudder be well hung and free in its movements, and that pieces to make a spare one are on board, and at hand in the hold. The tiller-ropes should be properly attended to, and examined at least once a day at sea, and occasionally in port, to detect chafes. If they are of raw hide (which are the most serviceable), they should be occasionally oiled. He should see that the spare tiller fits, and is at hand ready for use; that the relieving tackles are in their places; that the air ports and lower deck ports are well lined and secured in, or that the apparatus for closing them is always within reach, and ready for immediate use; that the bilge and force pumps are in good order, that the carpenter or one of his assistants ascertains at least every hour, while at sea, and every morning and evening in port, the quantity of water in the vessel, and that all the pump gear and the sounding rod are always kept in their proper places.

He should see that the compasses, timepieces, sandglasses, and log, have been verified; and that they and the chronometer are kept in their proper places and have a free motion. That the chronometers are well regulated, the rate known before sailing, and are regularly attended to. That everything belonging to the capstan and cables, such as the bars and swifters, the messenger, nippers, stoppers, hook-ropes, compressor-tackles and blocks, are ready for use. That the shackle-pins for the chains are kept well white-leaded, in order that the chains may be easily unshackled. That the vessel's draught of water be taken immediately before getting under way, and that hand leads and lines, properly marked and fitted, are placed in the channels abreast the mainmast. That the deep-sea lead and line are properly fitted, the latter being on a reel or in a tub; and, if a patent apparatus, that it is thoroughly understood and in good working order. That the tarpaulin covers for the hammocks, boats, hatches, capstan, binnacle, etc., are in a good state, and that the carpenter is always ready with gratings and battens for the hatches.

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He should see that the whole apparatus for securing and working the guns is complete, hand-spikes, port-laniards, quoins for the breech, cleats for the spare trucks, muzzle-bags and lashings, priming wires and boring bits, aprons, rammers and sponges, the latter with good tarpaulin covers, side and train tackles, port-bucklers, etc., and that the breechings are good and well fitted. That the fire-buckets are well fitted with laniards, and kept in their proper places; and that the wash-deck buckets are all marked. When the powder is on board, he should see that there are a certain number of cartridges filled, not only of the full but reduced charges. That the shot, as it is received on board, be all passed through the gauges.

That the arrangements for flooding the magazine are complete and in working order. That the shell room is dry, and properly stowed; shell-whips fitted and in place, and all powder-scuttles, shoots, &c., &c., made in accordance with the Ordnance Instructions.

The watch, quarter, and station bills, should be carefully made out, and *each person on board made acquainted with his proper station for each evolution, for action*—and his proper berth and mess.

In short, an officer responsible for the good condition of the ship, should himself see that all her arrangements, including a fire-bill suited to the vessel, are complete; and he should leave port fully prepared to encounter a gale, meet an enemy, or anchor on a lee shore.

Vessels are frequently ordered to fit out with the utmost dispatch. Sometimes a rivalry springs up between two ships fitting out at the same time, or, through a mistaken zeal, the work of fitting out may be unduly hurried; the consequences are, too often, that the ship is badly fitted, the holds carelessly stowed, the rigging not properly set up, stores deficient, sails not fitted, and nothing to resist chafe or the inclemency of the weather. The danger which such neglect entails is of the most serious nature. The ship gets outside, and bad weather comes on; there are no hatch-covers, hoods, boom-covers, no half-ports or bucklers. The sails split, to replace them is impossible: the rigging stretches; articles in the holds and spirit room fetch away; the guns work; and withal the crew is raw, undisciplined, and totally ignorant of their stations. In this situation the ship gets on a lee shore, or, what is far worse, she falls in with an enemy; the men are not quartered, cartridges not filled, stores not arranged, and the shot and shells do not fit the guns.* To avoid

* It is scarcely necessary to state that, with the present Ordnance Instructions, and the system prevailing at our yards, it is simply impossible for one of our ships to go to sea in such a condition, though an Executive officer may, by neglect, accomplish a great deal towards it.

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the disgrace and disaster which must ensue, a ship, before leaving port, should not only have the crew watched and quartered, as previously stated, but they should be exercised with the sails and guns as frequently as circumstances permit, that officers and crew may "shake down" in their places as soon as possible.

It is an old and very true saying, that however much care is bestowed on a ship's fitting out, she is never ready till at least a week after leaving port.

Above all let him consult the Navy Regulations, make a complete list of all reports required to be sent in before going to sea, and take care that they are correctly made out and sent through the proper channel.

CHAPTER XVIII.

BOATS.

THE principal boats used for ships are *launches*, longboats, *barges*, pinnaces, *cutters*, yawls, jolly boats, *dingeys*, *life-boats*, and *gigs*. Those in italics are common to our navy.

There are three different methods of building boats, namely:—

1st. The **Carvel-built,** which have fore-and-aft planks, the edges meeting but not overlapping.

2d. The **Clinker-built,** also fore-and-aft planks, with the edges overlapping each other, like shingling.

3d. The **Diagonal-built,** having, as the name implies, their planking running diagonally, the inside planks running in a contrary direction to the outside ones, and their edges meeting.

Boats are *single* or *double banked*, as they have one or two rowers to a thwart.

The seats for the crew of a boat are called the *thwarts;* the strips running fore-and-aft, on which the thwarts rest, the *rising;* the space abaft the afterthwart, the *stern-sheets*, and forward of the foremast thwart, the *fore-sheets;* the spaces in the wash-streak for the oars, the *row-locks.*

The *frames*, *knees*, *hooks*, *stem* and *stern* posts of boats are generally of oak, and the planking of cedar.

Oars are made of ash. The flat part of an oar which is dipped in the water is called the *blade*, and that which is inboard is termed the *loom*, the extremity of which, being small enough to be grasped by the hand is called the *handle.*

The oars are said to be double-banked when there are two men rowing at each oar.

Oars should be neatly marked by the carpenter, and the men not allowed to deface the looms.

To Feather the Oars, in rowing, is the art of turning the blades in a horizontal position, that they may not hold the wind.

In exercising boats' crews they should be required to feather their oars at the outset, and never permitted to neglect it.

BOATS.

Rules for Size of Boats for Ships-of-War. For the length of first *launch*, multiply the square root of the length of the ship by 2.6; breadth, $\frac{1}{4}$ of the length. First and second *cutters* of ships-of-the-line, and first *cutters* of sloops to be .9 of launch. Third and fourth *cutters* of ships-of-the-line, and second *cutters* of sloops to be .9 of first *cutter*. *Quarter, waist or stern boats* to be of the same dimensions as the third and fourth cutter of ships-of-the-line, or second cutter of sloops, but lighter built. *Gigs* same as third and fourth cutters.

A first-rate is allowed eleven boats—namely, 1st and 2d launch, 1st, 2d, 3d, and 4th cutters, 1st and 2d whale boats, barge, gig, and dingey. The Book of Allowances provides that one of the launches, of a 1st and 2d rate, to be fitted with a small engine and screw, of sufficient power at least to stem strong currents and tides.

To Find the Weight of Boats, multiply the square of the breadth by the length, and that product for a launch, by 2.5; first cutter, by 1.9; quarter boats, by 1.0; second cutter, by 1.4; stern boat, by 1.0. Answer will be in pounds.

The most common rig for cutters is the *lug*, while the sloop rig is preferred for launches.

Boats form a very important item in the outfit of a man-of-war, and those that are strong, commodious, and well found, are indispensable to belligerents in all river and littoral operations; for this reason great care should be taken before leaving the navy yard that the boat equipments are perfect, and the boats themselves the best kind for such purposes.

The naval histories of England and France are replete with accounts of boat expeditions, and of their many dashing exploits. Long experience taught the naval men of those countries the necessity of building strong and capacious boats, and of rigging and fitting them in the most thorough and serviceable manner, thus enabling them to make good weather, and to carry their large crews for weeks together in comparative comfort and security.

For the proper fitting out of boats for service, the student is referred to the Ordnance Manual; but there are fitments which belong *at all times* to *every boat*, the neglect of which, as it involves the lives of human beings, may be justly regarded as criminal. Among these we may enumerate the following: the plug, which should be secured to the keelson by a good laniard; a regularly fitted boat's breaker of water, the bung fitted with a spigot or faucet, and laniard, and the bunghole with a leather lip; a full set of stretchers; the most approved kind of arrange-

ments for "hooking on;" these may consist of short chain slings shackling to a ring-bolt in the keelson, forward and aft, and to one in the stem and stern posts; and for davit boats it is recommended to have the "hooks" in the boat and the "ring" in the lower block of the tackles; thus avoiding the danger of the tackles hooking under the gunwale and ripping it out, or under the thwarts. (Another good plan may be seen in the Davidson Apparatus.) A complete set of oars, when not in use, secured together and to the thwarts by sennit gaskets fitted to go with a becket and toggle; two spare oars to be triced up under the thwarts, and all the oars fitted with trailing lines; the masts and sails *kept in the boat;* the latter in a painted canvas cover, made for the express purpose; the rudder of davit boats so arranged that it *cannot be unshipped* without cutting the rudder-rope; the gripes fitted with slip-hooks; or, as sometimes called, crane-hooks, that they may be perfectly secure, and yet detached in a moment; a "lazy" painter and one good long painter or cable fit for mooring or towing by; one good boat rope leading from forward part of fore-chains stopped up with split yarns and secured in the boat's bows (this is absolutely necessary at sea and in a port where the tide is strong); life-lines depending from the fore-and-aft guys; two small spars to act as skids to be used when hoisting in a sea-way; one boat binnacle to be kept trimmed and at hand ready for any boat requiring it; the supply box, made perfectly water-tight, and containing the articles provided for by the Ordnance Manual.

At least one boat in every ship should be a good surf or life-boat, and fitted for lowering and hoisting with extraordinary expedition. In this connection, it may be mentioned that the LIFE-BUOYS should be of the most approved pattern, and that the contrivance for letting them go and firing them should be frequently examined and tested, and it is recommended to let these buoys go while the men are bathing, that various experiments may be made and the men familiarized with them. For the same purpose, grating, ladders, oars, &c., may be launched overboard, thus obtaining much valuable experience in their sustaining powers. These articles can be readily picked up by the boats, which are, or should be, in attendance upon all such occasions.

Boats should have their own recall, and the *cornet*, or general recall, painted on a piece of tin and tacked in some secure place. It is frequently painted on the back-board, but that is itself liable to loss. Besides the two flags named, it will be found very useful to have other signals, as, for instance, to indicate—"Pull more to starboad," "More to port," "Douse sails," "Look out for the buoy" (with line astern), "Return (to place from which you came) and wait for recall," &c., &c.

BOATS.

It is very difficult to ship a rudder when the boat is in the water—often impossible—and in the hurry and excitement of lowering a boat in case of emergency, if not permanently shipped, it is frequently forgotten, moreover it is difficult to steer with a rudder when going through surf; therefore a metal crutch to ship in the stern, so as to steer with an oar, would be found very convenient.

The manning and unmanning of boats would be much facilitated by using additional ladders: besides those astern, there should be others leading down from the mizzen channels, or from the end of the spare topsail-yard, and when "all boats" are fitting out, ladders from the fore chains would materially contribute to the order and rapidity of the operation.

Much trouble in rounding up, stopping up, and overhauling down boats' falls may be saved by hooking the blocks to small beckets, worked into staples or eye-bolts in the bends. They are always ready then for "hooking on."

Lowering and Hoisting. *For lowering*, boats' falls should be kept in separate racks, and always clear. A boat should not be lowered, if avoidable, while the ship has sternway; on the contrary, it is better if the vessel be going ahead. Should the boat get under the bows, there is danger in a sea-way of her being cut in two or stove by the dolphin-striker.

In a quarter or stern-boat, the after-tackle should be unhooked first, particularly when going ahead or in a tide-way, otherwise the boat may wind and be swamped.

On lowering a stern-boat in a tide-way, the moment the keel touches the water the boat is swept astern, and the falls so tautened that they cannot be unhooked without much difficulty, the men on deck holding on to the ends for fear of their unreeving; in the meantime the boat heels over, the gunwale catches the tide, and the boat is swamped. To prevent such mishaps, as soon as the boat is hoisted, hook a stout runner, fitted for the purpose, haul taut and belay it, and unhook the regular tackles. Now when the boat is lowered, the runner is allowed to *unreeve* instantaneously, and the boat is swept clear of the ship at once, or swings to her painter or line previously made fast.

When about to lower a boat, see the line from forward made fast, put the plug in, ship the rudder (if not permanently shipped), let the men in the boat hold on to the life lines, and keep the steadying lines fast until the boat is in the water.

For hoisting, the boat should be hauled up, a careful hand steering, or dropped from the line forward and the forward tackle hooked first. It is very important that these tackle should have

their lower blocks so made that they will not capsize, which is one of the many good points in the Davidson apparatus. When the tackles are hooked, the men should keep the blocks up so that they cannot unhook, by holding up the standing part of the fall. Steadying lines should be used in a sea-way, leading in through the ports and well attended, with which to bind the boat, as she rises, against the skids; the life-lines should be crossed and the boat-rope from forward tended. Send all but four hands out and hoist away. When the boat is up, pass the bight of the stopper through the slings—the short chain-spans which go from the ring-bolt in the stem and stern-post to keelson—or through the ring-bolts and over the davit-end twice, and hitch before attempting to belay the fall.

For hoisting quarter-boats in a sea-way, there is nothing like jack-stays from the davits to set up to the bends at the water-line. A lizard is fitted to each, which travels up and down. With these, catch a turn around the thwarts, and the boat may be run up, clear of the side, without trouble.

Pass the gripes round the boat clear of turns. Have squaring marks put on the falls, so that she may always hang square from the davits, and in port, level with the rail. If there be no scuttle which opens of itself, take the plug out the moment the boat leaves the water. Send the end of the cable and make it fast as far forward as possible, outside all, and stop it up to the chains with a cut yarn, or have a line from the fore chains for the purpose. See that the fenders are in, fill the water breaker, and if the weather be hot, put the cover or awning on square and smooth during the day, taking it off at night.

In a stern-boat in a tide-way, or ship going ahead, do not attempt to haul across the stern or hook the stern-tackle until all is ready on deck, and then hold hard by the life-lines, for the boat will suddenly fly forward as she leaves the water. The spanker out-haul, or a whip from the boom end, will guy the the boat off the ship's rudder.

Nearly every one of any experience at sea has some favorite little reminiscence to narrate of loss of life by drowning, nor do they fail to relate, in many cases, how the "poor fellow" *might* have been saved "but for a marine's shirt stopped to the boat's fall,"* or something equally fortuitous. In view of this fact, the foregoing suggestions relative to boats and life-buoys, brief and imperfect though they may be, are recommended to the earnest consideration of young officers, that they may not wait to learn the lesson at the expense of human life.

* Liardet relates an incident of this kind.

BOATS.

Orders used by Persons in Charge of Boats. The following orders are those most generally used by officers and others in charge of boats. A cutter, for example, is supposed to be lying alongside, properly manned, and ready to shove off:

Up Oars!

The crew, with the exception of the bowmen seize their proper oars, and, watching the stroke oarsman, raise them briskly to the vertical, simultaneously, holding them thus directly to their centre fronts, blades fore-and-aft, those on starboard side with right hand, those on port side with left hand, down and grasping handles; the oars to be held by the hands alone, *not resting on the bottom of the boat;* the face square aft, and pay strict attention to the coxswain.

Bowmen stand up, facing forwards, and attend the painter or heaving-line, or handle boat-hooks, as case may require. (They should not raise their oars until the order "Let fall" has been executed.)

In a sea-way, or strong tide-way, the after-oarsmen do not raise their oars at this command, but assist with boat-hooks in shoving off, and raise their oars together and before the order "Let fall."

At command:

Shove off!

Bowmen cast off painter or heaving line, handle boat-hooks, and shove the bow clear by a vigorous shove, the coxswain seeing that the ensign-staff and quarter goes clear of gangway (assisted by after-oarsmen, if necessary).

When the boat is sufficiently clear of the ship or wharf, the order is given:

Let fall!

The oars are to be *eased down* into the rowlocks simultaneously, and leveled. The blades should not be allowed to splash in the water. The fenders are then taken in, and the starboard stroke-oarsman gives the stroke. As the style of the stroke depends upon the after-oarsmen, they should be the best men in the boat.

(In double-banked boats, each man is responsible for the proper handling of his own fender; in single-banked boats, No. 2 takes in and throws out the fender of No. 1, No. 3 that of No. 2, &c.)

(The boat can now be pointed in the desired direction by directing the proper oars to be backed or given way upon.)

BOATS.

The bowmen, having shoved the boat clear, turn aft, take their seats, and lay in their boat-hooks together, and. having hauled in and coiled down the painter, if adrift, seize their oars, and, looking at each other, throw the blades over the bows, in line with the keel, simultaneously; when the looms and handles are grasped, the oars are raised vertically together, and dropped simultaneously into the water. When the boat is properly pointed, the coxswain commands:

Give way together!

The starboard after-oar gives the stroke, the others follow him. Each oar should be lifted as high as the gunwale, and feathered by dropping the wrist until the blade is flat, a brief pause being made when the oar is level with the gunwale, long enough to feather the oars. When the blade is thrown forward as far as the row-lock will admit, it is then dropped, edgewise, into the water, easily and without splashing. At the middle of the stroke each man throws his weight upon the oar. (Rowing hand over hand, or from the shoulder alone, should never be permitted.)

On approaching the desired place of landing, the boat being properly pointed, at the moment the oars are leaving the water the coxswain commands:

In bows!

The bowmen, closely regarding each other's motions, take one stroke, and, tossing their oars simultaneously, raise them vertically, lightly touching the blades together, letting them fall into the boat together, in line with the keel, without unnecessary noise, and pass the handles underneath the oars still in motion, taking care that their oars are "boated." They then seize their boat-hooks, face forward, and, standing up, hold their boat-hooks vertically.

When with sufficient headway to reach the desired place of landing, the command is given:

Way enough!

As before, the command is given *while the oars are in the water.* The crew, regarding the motions of the stroke-oarsman, give one stroke and toss their oars simultaneously, raise them to a *vertical position*, and lay them easily and without noise into the boat, in line with the keel. The oars to be so placed in the boat that they can be readily resumed by the crew, the stroke oars to be placed nearest the gunwale, and the others in succession.

The oars being boated, the stroke-oarsmen handle their boat-hooks, keeping their seats, and assist the bowmen in bringing the boat to the landing.

BOATS.

After boating the oars, the fenders are thrown out.

In saluting passing boats—in stopping to hail or to check headway—it may become necessary to lay on the oars; to do this command—

Stand by to lay on your oars!

At this the men pay strict attention for the command—

Oars!

which is given while the oars are in the water, the stroke is finished and the blades of the oars are feathered and raised simultaneously as high as the gunwale, where they are firmly held in lines parallel to each other—on no account are the oars to be permitted to touch the water or to be thrown out of line.

At the order—

Give Way!

the pulling is resumed, each man regarding the stroke-oars, and taking the stroke from them.

To toss oars, the command is given—

Stand by to Toss Oars!

At the command—

Toss!

which is given while the oars are in the water, the stroke is completed, and the oars then thrown up to a vertical position simultaneously, blades athwartships—each oar is held square to the front of the man holding it—on line with the centre of the body.

In going alongside of a strange or foreign vessel to deliver a message or order, requiring but a few moments to give or execute, and particularly when it is desired to keep the crew at their thwarts, it is recommended to give the order *Toss*, rather than *Way enough!* The crew to keep their oars up while the duty is performed by the midshipman in charge. The bowmen being the only men in this case, who "boat their oars."

To trail, give the command—

Stand by to Trail!

Trail!

At the second order the oar is to be thrown out of the row-lock, and allowed to trail alongside, either by the trail line or by holding it by the handle.

To stop the boat's headway, order:

Oars!

Followed by—
Hold Water!
And if necessary—
Stern all!

At the first order, lay on the oars as directed; at the second, drop the blades in the water to check the headway; and at the third, pull backward keeping stroke with the after-oars. The oars should not be dropped into the water too suddenly lest they get broken.

To turn a boat suddenly, order, *Give way starboard* (or port), back port (or starboard), *Oars!* Both backing and pulling oars should always keep stroke with the stroke oar of their own side.

Boat Salutes, &c. Tossing and laying on oars are two methods of saluting superior officers (see U. S. Navy Regulations). On observing the approach of such give the preparatory command in good time, and when at such a bearing and distance that the salute can be best observed and acknowledged, give the order of execution, permitting the boats, to pass before resuming the stroke. The officer and coxswain salute by raising the cap at the time of saluting with the oars. Instead of tossing, single-banked boats trail. Loaded boats are not expected to salute. A junior should never pass his superior officer, when pulling in the same direction, except when on urgent duty. When two boats are contending for the same point, and it is at all doubtful which will reach the landing first, courtesy should prompt a young officer to lay on his oars and let the other pass.

Coxswains should always rise and uncover when passing a commissioned officer.

It was formerly the custom to return the salute of a boat, by a salute in kind, with the bow oars of the boat containing the officer saluted.

When pulling in for a landing among a crowd of boats, or under other similar circumstances, it will often be found convenient to *lay on your oars*, and let the boat run in, when, if she goes far enough, *boat your oars*, or else give a few strokes more and then *way enough*. This avoids dashing in, colliding, breaking oars, boat-hooks, and may be staving your own boat.

Good Order of Boats. Nothing sooner indicates the order and discipline of a vessel-of-war, than the clean state and efficient condition of the boats, together with the personal appearance of their crews. In this particular, sufficient care is not always observed; in well-regulated ships, the coxswains are compelled to report to the senior lieutenant the state of their respective boats, and in the morning to ascertain from the officer of the

deck, the manner in which he may require the crews to be dressed for the day, &c.

Boats' Crews for ordinary duty need not be composed entirely of able seamen. Landsmen are soon taught to pull a very good oar; but for the life-boat's crew, a set of active seamen should be selected from each watch, having six or eight supernumeraries to supply the places of any who may be on the list or aloft, when wanted; these should be mustered every night at sea. In port, the crews of the passenger boats should be mustered every morning and inspected in the gangway by the officer of the deck. In some ships, one boat's crew is required to keep themselves in the gangway ready for a call at any time, and they are made to man their boat from the boom, and not from the gangway; this, of course, in ports, where the boats are in constant use. Three minutes from the time a boat is called away, till she is at the gangway, manned, is very good time.

Boat's crews should always wear their hat ribbons.

Carrying Stores. When provisioning ship, be careful with the oars, as the blades are easily ruined by throwing them on stones or by treading on them; keep all casks "bung up" and leave space under the after thwart for baling the boat out. Have tarpaulins for covering bread or anything that will be injured by salt water. Sling the midship casks as they are stowed. While loading, make large allowance for the roughness of water you may have to encounter.

Remember that a laden boat carries her way longer than a light one, therefore shorten sail or "way enough" in good time.

As they are apt to take under chains, ports or other projections from the ships or wharves, never toss oars while going or coming when there is any considerable motion.

When ordered on boat duty, it is well to remember your men's meal hours, either taking the provisions in the boat, or warning the master-at-arms that the crew will be absent. See that the gear—masts, sails, oars, fenders, boat-hooks, baler, anchor and cable, painter, flags, breakers, water, rudder, awning, and stanchions—is complete, and that the crew are properly dressed. It has been found very convenient to keep a supply box always in each boat, containing a pistol, flash-pan, powder, caps, a rocket and blue light, hatchet and a few nails, &c. (See Ordnance Manual.)

A boat officer is always supposed to have his spy-glass, watch, and signal-book, at hand; and it is well to make certain that *orders are rightly comprehended before leaving the ship.*

BOATS.

Boats taking in water in bulk. Some vessels water in this manner, without the least wear and tear of casks, rope, &c. The launch or largest boat you intend for the purpose of watering, must be cleared of all her gear of every description; then tow or pull her to the watering place, where she must be well washed out with fresh water several times, until perfectly clean; when done, put the hose into the boat, and merely leave a couple of hands to attend it until the boat is full; then, by a signal from the shore, or otherwise, send a boat to tow her off to the ship; pump the water out of the boat into your tanks, and so on until you complete your water. If in a river, pull the plug out and let her fill.

Carrying Sail. If about to sail, get the sails taut up before shoving off; see that the yards are slung, so as to set the sail smoothly. Never stretch the head of your sails in bending them; bring them to the yards and gaffs barely hand taut. Make all the men who are not about to shove the boat off, sit down; haul up; sheer off; in fenders. As a general rule in sailing, insist upon the crew sitting down on the bottom boards of the boat.

The hauling end of lug halliards is always long enough for a down haul. Splice an eye in its bare end, and put this eye over the hook of the traveller before hoisting.

Keep your weight amidships, and never belay the sheets.

Care should be taken that the halliards be coiled up clear for running; that the crew, in shortening sail to a squall, do not shift their seats, or, as is too common a custom, stand upon the thwarts to gather in the shaking sail; in lowering a lug, or lateen sail, haul down alone on the luff (the fore-leech); the after one better be left untouched.

Coxswains should also be cautioned of the danger of letting go the helm. This is often inadvertently done—sometimes to secure the heel of the bumpkin, or to get a pull of the main or jigger sheet. By this thoughtless practice, boats are liable to fly up in the wind, the sails to be taken aback, be difficult to lower, and eventually to cant over and capsize the boat to windward.

Before reefing on a wind, tell the men off for the different duties; the two bowmen to gather down on the luff; two weather hands by the halliards and down-haul; the lee hands to tie the points; one stroke-oarsman to attend the sheet, the other to assist the coxswains in reefing the jigger. No person need stand up. Good boatmen never jump about on the thwarts, or show more than their heads above the gunwale. Do not luff up; check the sheets; lower enough to shift the tack hooks easily;

gather the fore-sheet aft, that the men may reach the foot of the sail without leaning over the lee gunwale; shift the sheet; tie away; slack the sheet; hoist; resume places, and haul aft. Should the jigger be reefed more quickly than the foresail, do not haul its sheet aft until the boat has steerage way on, else she will get in the wind, and lose time.

In boom boats, set the jib before setting the foresail, taking care to have the runners hand taut before hoisting. The jib is the forestay; and if the foresail be set first, the mast-head is dragged aft, and the after-leech hangs slack. If obliged to set the jib after the foresail, ease the fore-sheet off while hoisting the jib, and let the mast-head go forward into its place.

In shoving off when the ship is not head to wind, pull well clear of her before making sail.

Remember, in running, that you cannot carry all the canvas on a wind that you can before it; therefore make ready for rounding to. Running with much sail dead before it, in a gig, is dangerous. If the wind comes a little on the sheet quarter (say starboard), it is safest to haul up to port; and when the wind is on the port quarter, haul in the sheet; lower; shift the sail round; resume course, and hoist on the port side.

When you want a pull on the halliards, let go the sheet; if the fore, check the jigger at the same time.

Dipping a lug is the neatest handed affair a boatman has to do. You must tell the men off; the bowmen to bear the fore part of the sail out, the two next to gather the sheet of the sail forward and pass it round, the after-hands to unhook and hook the sheet, the others to *sit fast*, shifting the halliards and handing the foot along, and hoisting when ready. Do not lower until the fore part of the sail has been aback sufficiently to bring the wind on the other bow, unless it is smooth and you have great way on; but the sheet may be unhooked the moment the sail lifts. Keep your halliards with a mark, so as not to lower the yard more than is necessary for dipping the after yard-arm; you will have more back sail to carry you round, and less slack sail on top of your men. Attend the jigger-sheet in case the boat should "come to" while rehoisting foresail.*

If your men are all sitting to windward in a breeze, make them occupy their proper places amidships, before passing to leeward of a vessel. There is not only an eddy wind under the stern of a ship that is riding head to wind, but also frequently an indraught of water, and it is not uncommon to see an inex-

* It depends upon the cut of the lug whether the forward or after yard-arm is dipped.

perienced young officer trying to pass close under the stern suddenly taken aback, and his mast-head, which at one moment was looking quite clear of the boom, thrown to windward and entangled by it.

When caught in a hard and sudden squall, put the helm down at once, let fly the fore sheet; and as such squalls frequently veer more or less, lower the sail; for if it catches aback there would be difficulty in getting it down, danger and sternway from keeping it up.

In moderate squalls, and where the officer is confident of himself and his men, it is best to ease off the sheets sufficiently to relieve the boat, keeping such steerage way on as to insure a touch of the lee helm and a pull on the jigger sheet, bringing her into the wind should the squall increase. When the wind fails, get out oars at once. If your men have had a long pull, the commanding officer will, at your representation, excuse them from further duty: but unless already fatigued, your business is to perform the service expeditiously. As the breeze springs up, be careful with the lee oars, lift the looms out of the row-locks and lay them on the gunwale, as it occasionally freshens, and when the danger of "catching crabs" is likely, lay them in altogether. When, in consequence of the boat's inclination, the weather oars barely strike the water, it is a sign that all oars should be in, and the crew seated in the boat's bottom. If in haste, working to windward, pull the weather oars.

Boats with one sail, as a lug, should never attempt to beat to windward.

The "rule of the road" and the remarks about handling ship apply equally to a boat. You may bring her to such nicety of trim under sail, that in moderately smooth water she will go round without any assistance.

Putting the rudder right across the stern deadens the way; 42° is considered the extreme of efficiency.

When there is no way on, or when the boat is tied by the stern—as in towing, when the tow-line is fast to the wrong place, as the stern ring-bolt—the rudder has no effect whatever.

If your boat hangs in stays, and has just lost or is about to lose her way, you may (possibly) get her head round by a jerk of the tiller, but it looks very silly to be going through the motions of steering when there is no way on.

In all cases of steering, endeavor, either by trimming sails or disposition of weights, to reduce the boat to what is called a "small helm," that is, that a very little effort will be required to move the boat's head either way; for when the rudder is dragged

much across the stern, the way is retarded. Weather helm will be induced by allowing the boat to be pressed by the head, and this may be caused by the bowmen sitting forward, or by press of sail, or both. If the bows are clear, a pull on the jib sheet *might* relieve the helm, but not as a matter of course; for if the jib was already flat, it might be the cause of depression, and a few inches checked would perhaps answer the purpose. Then the jigger might be the cause, and an inch of that sheet might be the remedy. But it will be of no use to attempt trimming until the sails are taut up and well set; and then the officer in command can make his arrangements and alteration of trim, until the boat may be so nicely balanced that, by sending the bowmen forward and letting go the tiller, she will go about of herself.

If the bow is deep and the stern light of draught, the former is not so easily blown from the wind as the latter. If, on the contrary, the stern be deep, and the bow light, the bow is readily thrown to leeward by the conjoint action of wind and sea. In the first of these cases—supposing the sail to be well balanced—the boat would carry weather helm; in the last, lee helm; but in either, her way would be more or less diminished. The drag of cross helm might be decreased by reducing sail at one of the extremities, but at the expense of speed; whereas, by *trimming weights*, all sail might be carried, and speed increased.*

Boats blown off the land, or otherwise adrift, have ridden out heavy seas by riding at their spars, which, after being lashed up in a bundle, were thrown overboard, with the cable bent span-fashion to them.

When such a measure is resorted to, the sails should be loosed on attaching their yards to the spars; they will thus contribute greatly to breaking the sea, and if weights be fastened to the clews, the boat's drift will be much retarded. Two oars, at least, should be retained in the boat, in case of breaking adrift.

Sails or spars towed astern, while running in a heavy sea, will very much diminish the risk of being pooped.

Boarding. If it comes on to blow while absent on duty, you will most probably be signalled to remain where you are till it moderates. If you return, either round to ahead, down masts, out oars and drop down; or else, if you have confidence, shoot up under the stern, and down masts before getting under the quarter boats.

Before going alongside a vessel under-way and hove to, observe if she have head or stern way, and in any case get the masts

* Precisely the same principles obtain in ships.

down before closing her; otherwise, if the bowman fail to catch hold, and the mast-head be fouled, a capsize is nearly certain. Wait until the ship has gathered headway, and then go alongside. While there, have a stern as well as a bow rope, but do not let them be made fast in your boat. Do not shove off during stern-way, else the ship, in settling to leeward and falling off, will bring you under her bows, and, with her stem and dolphin-striker, cut you down.

When being towed alongside by a vessel, contrive to have the rope from as far forward as possible, so as to avoid riding at a short stay; never make it fast, but toggle it with a stretcher through the aftermost of the foremost sling-bolts, so as to be able to slip in an instant. Steady it near the stem with the bight of the lazy painter passed over it.

If being towed astern, the closer the better. And when about to be cast off, either be dropped astern clear of other boats, or be handy with your oars, so as to shoot out clear of other boats which may be in tow.

Do not permit other boats to hang on by your boat. If other ropes are not supplied, get more of your own tow-line, and after securing its bight as before said, pass its end aft; and if it is not long enough, bend the nearest boat's painter on to it; otherwise your stern or stem will be dragged out.

When you go on duty to another ship, return to your boat the moment that you have delivered your message, and wait for orders. If in a tide-way, ask for leave to hang on by the boom. A careless officer goes below; his boat's crew block up the gangway, commence conversing through the ports, are disrespectful to strange officers, and bring a bad name on their own ship. When a boat officer must be absent from his boat, he should leave his coxswain in charge, with positive orders concerning his duty.

In coming alongside, lay the fenders out and get the bowspit in in good time, especially if it be an iron one. The general rule is to keep the main yard of the ship end on; but that must depend on tide-way, and whether the boat is heavily or lightly laden.

The boat should be baled out, slings hooked, and otherwise prepared for hoisting, before reaching the ship.

Make due allowance for the rate at which the tide is going past the ship, or the rate at which she may be moving, when making for her. A current frequently sets close along the shore in the opposite direction to the one that is going by the ship; and, therefore, a little judgment may save a long pull. An inquiring

boat-officer will learn more of the theory of local tides and currents by a chat with a waterman, than can be found in books; and by observing, when abroad, the manœuvres of native boatmen, much labor and risk will be avoided.*

Before leaving a ship or place in thick weather, whether you have a compass or not, get a bearing of the whereabouts you intend reaching.

Towing. In taking another boat *in tow*, pass clear of her oars; place yourself right ahead, exactly in line, and give way the instant that you have hold of her painter. Do not give another boat your painter, until she is in line ahead of your boat. Take the tow-line to the foremost stern-sling bolt, and toggle the bight with a stretcher. If you wish to turn your boat's head, bear the tow-line over the quarter on that side to which you desire to turn, for the helm will be of little or no use.

In towing short round, do not attempt to turn before your leaders are round.

The heaviest boats should always be nearest the tow.

Boats will tow with increased effect if weighted with shot. A few lengths of stream chain is the quickest weight that can be passed in and out, besides being less damaging to the boat.

Taking another boat in tow without delaying the duty by fouling her oars, or getting athwartships, is a very neat performance for a young officer, and, when well done, betokens judgment and skill.

Whatever theorists may say to the contrary, most practical men prefer towing spars by their smaller ends.

Towing Fire Ships, or Vessels on Fire. When boats are sent on this service, it will be well to provide them with a few lengths of small chain, to make fast to the burning vessel; fire-grapnels would do well to throw on board, and then make fast the tow-rope to the chain of the grapnel, for the boats to tow from. There are many instances of tow-ropes and hawsers being burnt when employed on this service, and other vessels much endangered from want of this precaution. If hawsers are sent to be made fast to a burning vessel, with the intention of warping her clear of other vessels, a length of stream-chain cable will be found much safer than trusting to rope alone; for though the fire may be some distance from the hawser or rope when you make it fast, yet fire spreads so rapidly, when the material of a

* Young officers should avail themselves of every opportunity to steer by a *range*, for they will frequently find coxswains who cannot steer a straight course athwart a strong tide.

ship is taken into consideration, that it never can be safe to trust to rope alone.

Warping. *A warp* is a rope or hawser employed occasionally to remove a ship from one place to another in a port or river.

To warp a vessel is to change her situation by pulling her from one part of a harbor to another, by means of warps which are attached to other ships, buoys, certain stations on shore, &c. The ship is then drawn forward to those fixed points, either by pulling on the warp by hand, or by application of some purchase, as a tackle or capstan.

Wet warps require careful seizing. While hauling ships about the harbor we never see the warps laid out by the dockyard riggers (however wet), slip or come adrift. They make four parts of their spunyarn seizings, take a round turn with the bight of this round the standing part of the hawsers, then pass the seizing (figure-of-eight fashion) round the hitched and standing part, then cross opposite ways with two parts each way, reeve the ends through the bights and drag all the turns taut.

The quick way to run a short warp out, is for one boat to run away with the end, and the others to pull in fore-and-aft under the bights as they are payed out at equal distances, according to the length of the warp and number of boats, giving way the moment they have got hold.

In all cases, when you take in the end of a warp, coil enough of it forward so as to be able to make a bend the instant your boat reaches the place you wish to make fast to.

It is hardly possible to lay a heavy warp out without floating its bight. If there is a chance of its being suddenly tautened, hang it outside the boat, instead of laying it fore-and-aft amidships.

In running warps out, the whole warp is sometimes coiled in the boat, and the end being made fast to some desirable place, the boat makes for the ship ; in other cases, a part only is coiled in the boat, and she carries the warp from the ship to the place to which it is to be secured. Whichever way it be, there is great judgment required in reserving a sufficiency of hawser in the boat to insure that she will reach her destination, only paying out when certain of doing so. It is from this necessity for judging the distance by the eye, that we have the term "guess-warp."

When confident of a good guess, wind or tide being favorable, take the warps in the boat, pull to windward and run them out from the make-fast to the ship.

BOATS.

When you are presented with the end of a hawser to run out, and which is not becketed, put a hitch on it and stop the end down at once.

Kedging. When the operation of warping is performed by the ship's kedges, these, together with their warps, are carried out in the boats alternately, towards the place where the ship is endeavoring to arrive, so that when she is drawn up close to one, another is carried out to a sufficient distance ahead, and being sunk, serves to fix the other warp, by which she may be further advanced; the first kedge is then weighed, sent ahead, and the operation repeated. This is commonly called *kedging*.

When great expedition is required, the boats should be equally divided into two parties, the light boats towing the larger containing the kedge and hawsers. As soon as the first kedge is let go and the ship started ahead, the other set may "pay and go," so that when the first is at a "short stay," the second may be let go, and the ship thus kept going continuously.

In making preparations, it would be well to clear the decks of all obstructions, sand down, have music in attendance, and if a dead calm, furl sail.

Kedging the Constitution. The evolution of kedging was practised on board the Constitution, during the exciting chase in which she escaped from the British squadron, under Sir Philip Broke; and, as other points of seamanship were involved in her management at that time, it may not be inappropriate to give a brief account of the affair.

At 2 P. M., on the 17th July, 1812, the Constitution being in 22 fathoms of water, off Egg Harbor, four sail were discovered to the northward and in shore of her, apparently ships-of-war. But the true character of the strangers was not discovered until early daylight of the 18th, when two sail were discovered under her lee, which proved to be frigates of the enemy, and the dawning day revealed another frigate astern, within five or six miles, and a line-of-battle ship, a frigate, a brig, and a schooner about ten or twelve miles directly astern, all in chase, with a fine breeze, and coming up fast, the Constitution being almost becalmed. Soon after sunrise it fell to a dead calm, and having lost all steerage way, the ship's head fell off towards the two frigates that had been first discovered under the lee. The boats were instantly hoisted out, and sent to tow the ship's head around and to endeavor to get her farther from the enemy, being then within five miles of three heavy frigates. The boats of the enemy were likewise got out and sent ahead to tow, by which, with the light air remaining with them, they came up very fast. Commodore Hull,

in his official report of the affair to the Secretary of the Navy, thus proceeds:

"At eight, four of the enemy's ships were nearly within gunshot, some of them having six or eight boats ahead, towing, with all their oars and sweeps out, to row them up with us, which they were fast doing. It now appeared that we must be taken, and that our escape was impossible—four heavy ships nearly within gunshot, and coming up fast, and not the least hope of a breeze to give us a chance of getting off by outsailing them.

"In this situation, finding ourselves in only twenty-four fathoms water, by the suggestion of that valuable officer, Lieutenant Morris,* I determined to try and warp the ship ahead, by carrying out anchors and warping her up to them; three or four hundred fathoms of rope were instantly got up, and two anchors got ready and sent ahead, by which means we began to gain ahead of the enemy; they, however, soon saw our boats carrying out the anchors, and adopted the same plan, under very advantageous circumstances, as all the boats from the ships furthermost off were sent to tow and warp up those nearest to us, by which means they again came up, so that, at nine, the ship nearest us began to fire her bow guns, which we instantly returned by our stern guns, in the cabin and on the quarter-deck. All the shot from the enemy fell short; but we have reason to believe that some of ours went on board her, as we could not see them strike the water. Soon after nine, a second frigate passed under our lee, and opened her broadside, but finding her shot fall short, discontinued her fire; but continued, as did all the rest of them, to make every possible exertion to get up with us. From nine to twelve, all hands were employed in warping the ship ahead, and in starting some of the water in the main hold to lighten her, by which, with the help of a light air, we rather gained on the enemy, or, at least, held our own. About two in the afternoon all the boats from the line-of-battle ship, and some of the frigates, were sent to the frigate nearest to us, to endeavor to tow her up, but a light breeze sprung up, which enabled us to hold way with her, notwithstanding they had eight or ten boats ahead, and all her sails furled to row her to windward. The wind continued light until eleven at night, and the boats were kept ahead towing and warping to keep out of the reach of the enemy, three of the frigates being very near us. At eleven, we got a light breeze from the southward, the boats came alongside and were hoisted up,† the ship having too much way to keep them ahead, the enemy still in chase and very near.

* The late Commodore Charles Morris.

† See "purchasing boats."

BOATS.

"On the 19th, at daylight, we passed within gunshot of one of the frigates, but she did not fire, perhaps for fear of becalming her, as the wind was light. At 9 A. M., made a strange sail on the weather beam, supposed to be an American merchant ship; instantly the British squadron hoisted American colors, in hopes to decoy her down, but I immediately hoisted English colors, that she might not be deceived; she soon hauled her wind and made her escape.

"On the 20th, at daybreak, only three of them could be seen from the mast-head, the nearest of which was about twelve miles off, directly astern. All hands were set to work wetting the sails, from the royals down, with the engine and fire-buckets, and we soon found that we left the enemy fast. At a quarter past eight, the enemy, finding that they were fast dropping astern, gave over chase, and hauled their wind to the northward, probably for the station off New York."

For a graphic history of this chase, and a description of the seamanlike manner in which the Constitution was handled during the squall which followed the protracted calm, see Cooper's Naval History.

Parachutes. Small sailing vessels-of-war were formerly provided with immense oars, called sweeps, to be used in sweeping ahead in calms. The Essex, during her celebrated cruise in the Pacific, under Commodore Porter, made use of parachutes, which were dropped from the spritsail-yard, and having a hauling line led in through blocks on the quarters, the watch clapped on, and "walking away," managed by this means to warp the frigate ahead a knot or two per hour.

A parachute is a contrivance of canvas that will open and shut like an umbrella. By hauling on the line aft, it is opened out and offers its greatest resistance to the water, thus forcing the ship ahead; and on hauling it forward again, it closes up.

Should a sailing vessel, or a disabled steamer, while becalmed, be attacked by a steamer, means similar to the above, or resort to the boats must be had, to bring the broadside to bear.

General Duties. A gig's crew may haul up their own boat, but for all other boats, it requires at least double the number of their crews, assisted by rollers and tackles.

A line-of-battle-ship's launch may be hauled up by five-and-forty hands, in the following manner: run her bow on to the beach, and let a few hands on each quarter keep her in that position, by setting their oars against the ground; next, sweep her with a hawser, and guy it up at the stern to a proper height

by several turns of the painter; to this hawser hook on the double block of a long tackle, the other end, or single block being overhauled to a proper length, and hooked to the boat's anchor buried in the ground, with one hand on it to prevent rising.

Pass the bight of another hawser round the stern post, and having guyed it up on each side to the gunwale, hook on, on each side, a quarter tackle also, overhauled to a proper length, and hooked at the other end, as most convenient; man these with the remaining hands: then, having placed rollers in succession to take the boat's forefoot and keel, proceed to haul away. When up, the loose thwarts set against the ground and wash-streak will keep her upright. Smaller boats do not require quarter tackles; a few hands on the quarters to keep them upright, answer the purpose. Heavy boats especially should not be turned bottom up, as it strains them so much. The loose thwarts might be placed for the rollers to roll on, if the ground is soft.

Sea-weed is as good as soap on the "ways." All boats should have a hole in the fore foot, through which a strap for the tackle could reeve. When the tackle is made fast to the boat at the top of her stem, her gripe becomes buried in the ground.

You will get your boat under a low bridge, or under a weight that cannot be raised high enough to clear the gunwale, by taking the plug out.

When weighing anything heavy over the stern, bear the rope amidships, and step the awning staunchion over it. Otherwise, if while rolling or from other causes, the rope flies over the quarter or side, the boat will fill.

In the entire absence of usual resources, great weights, such as a gun, for instance, may be got into a boat where there is a rise and fall, by filling the boat at low water with dunnage or sand, banking up an inclined plane with shingle, rolling the gun into the boat, clearing out the sand, and waiting for the tide to float her off.

In blowy weather or heavy tides, if a small hawser be carried round the ship outside all, the bight being made fast to the bowsprit cap, suspended on both sides from each lower yard-arm and spanker-boom end, by whips with bowline knots, and the ends reaching the water astern, boats may not fear to make for the ship anywhere without running against her; for while the hawser is out of the gangways, triced up when not in use, the quartermaster of the watch can drop it on top of a boat, and avoid the frequently too late cry for a boat rope.

BOATS.

In blowy weather boats should be moored at the boom with a hawser from the forecastle, led through blocks on the bowsprit end and boom with an inhaul to the gangway. Thus the spar will be relieved of strain, the boats will be more readily manned, and the danger of men falling overboard, while trying to get into the boats from the boom, avoided.

Boats may be kept clear of the ship, when riding astern, by causing them to tow a grating, or bucket, or a net full of shot.

The best way to transport on land, a moderate-sized boat, is to turn her bottom up, and shoulder her by the gunwales.

It frequently happens in preparing for sea, that a large boat's bottom, such as a launch, or other boom boat, requires cleaning. If there happens to be no place at hand to haul her up on shore, hoist her out of the water by the cat, and a tackle to the bowsprit, and scrub her bottom from another boat (or catamaran), in preference to doing it aboard.

Weighing Anchors, with Boats fitted for the purpose. For weighing anchors, the heavy boats have a copper funnel which screws down over a screw tap in the bottom of the boat; immediately over the funnel is fitted a windlass.

Rig the windlass and funnel, and if the buoy-rope can be trusted, reeve the end of it up through the pipe in the bottom of the boat, take it around the barrel of the windlass and heave up. Then bring the boat under the bow, and sweep a stout strap, with a small line made fast to each end, under the bottom, so as to cross the parts, and take a round-turn around the shank of the anchor. Bring the ends up on the same side, hook the fish-tackle, and walk the anchor up, crown first, until the ring is high enough to hook the cat. Should it be desirable to get the anchor up *ring* first, it may be done by sweeping the stream-cable under the boat (so as to catch between the stock and the flukes), forming a running clinch with the end around the other part, and hauling through the slack; then heave in on the cable, ease off the buoy-rope, haul the boat out of the way, and hook the cat to the ring when high enough. If a portion of the cable should be attached to the anchor, sweep under it, take the end through the hawse-hole, and heave in.

NOTE. Should the buoy-rope not be strong enough to weigh the anchor, form a large running clinch (to catch the upper fluke) around it, and let it run down. Then jamb it taut, and heave up. A jury windlass may be rigged in the absence of a proper one, by having a round spar secured athwart the boat, and working it with selvagees and heavers—having the hawser, buoy-rope, or cable, led over a davit at the stern.

BOATS.

Davidson's Boat Apparatus. Fig. 390, Plate 76. Enough has been said in regard to the precautions necessary to be observed in lowering a boat at sea, to show the value of a good contrivance by which the boat can be placed in the water, and instantaneously freed from all connection with the ship, or detached, if need be, before touching the water. Such a contrivance is comprehended in the Boat Apparatus invented and patented by Hunter Davidson, late of the U. S. Navy, one of the most valuable improvements extant in all that relates to the lowering, hoisting, and securing of boats.

Lowering. Fig. 390, Plate 76. One of the boat's crew, on being "called away," slips up the ring of the *slip-hook* and disengages the gripes; another lowers away on the lowering-*a*, Fig. 390; this permits the *reel* R, to revolve and give off the two chain pendants *p*, *p*, *p*, *p*. When the boat is down, or *at any moment during its descent*, at the option of the person in charge, a pin T (Figs. 390, 391) is withdrawn, which slacks up the *latch string k* (Fig. 390), and allows the latch *f* (Figs. 392, 393), to drop, and the toggle *t* (Figs. 392, 393), to fly out; *t* and *l* being jointed very loosely, unreeve instantaneously through the *ring r* in the end of the chain pendants, and the boat is free.

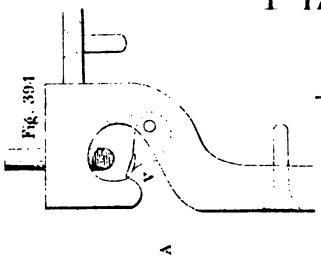
The Detaching Hooks, consisting of the entire Figs. 392 and 393 (except the ring), are of wrought iron, having all the joints to work loosely, and are securely bolted to the inside of the stem and stern post, standing nearly perpendicularly; *o*, *o* (Figs. 392 and 393), in breadth over twice that of *l*, bolts to the boat; in its lower end is a mortise, s, having its upper side an inclined plane, and the toggle *t* is shaped to conform to it, fitting loosely. Persons familiar with the Lewis-bolt may understand this *toggle* if compared to it; the principle is the same, but instead of the plug which confines the former, the bolt (toggle) is secured by a *latch*.

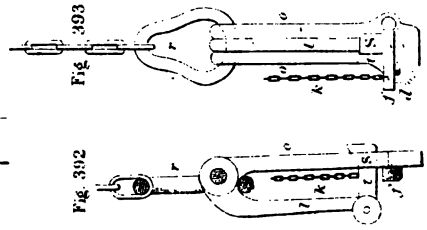
To guard against accidents, there is a hole *d* (Fig. 393), under the latch, in which a *safety-pin* is inserted, when the boat is secured for a gale of wind. The detaching hooks should be overhauled occasionally and oiled, though, if made properly, they will stand a great deal of neglect before getting out of order.

The Reel consists of a barrel similar in size and arrangement to that of the ordinary steering wheel, and may work on braces and sockets, as in Fig. 390, or in the mizzen channels. It has an iron casting at the ends, and a spindle to turn in the sockets; also three staples, one in the middle for the end of the *lowering-rope*, and one at either end for the ends of the chain pendants.

Pendants. These are small tough chains, which should be well tested and fully capable of sustaining twice the weight of the boat

PLATE 76





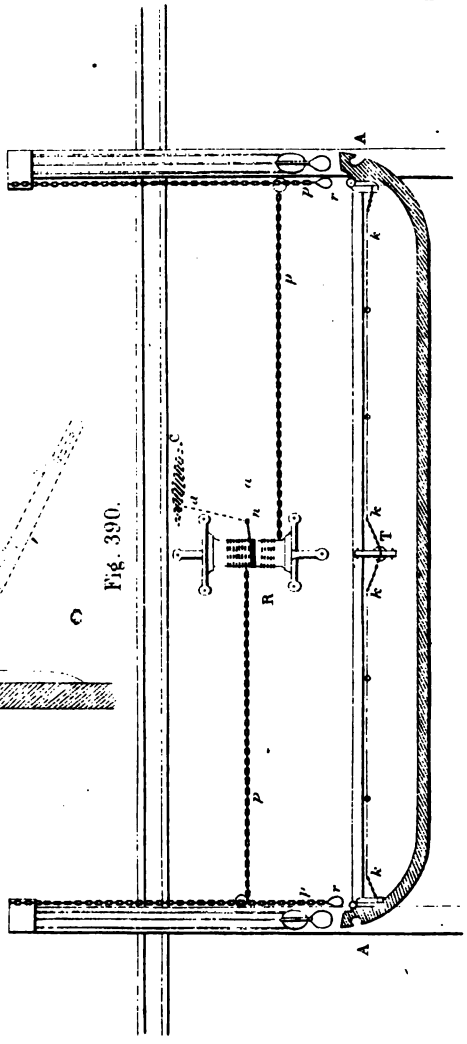


Fig. 390.

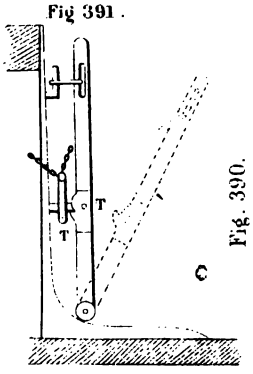


Fig 391.

and crew. The standing parts are secured to staples in the reel the chains then pass each through a couple of sheaves on the foot of the davit, thence through side sheaves at the davit head, and terminate in a jew's-harp link or ring (r, Figs. 390, 392, 393), which is embraced by the detaching hook when ready for lowering (r, Figs. 392, 393). The sheaves at the foot of the davits are found necessary in order to increase the friction, otherwise the strain on the lowering-rope would be too great.

The Lowering-Rope is secured to the staple in the middle of the barrel, passes through a fair leader *n* (a smooth brass roller in the ship's side), through the bulwarks, or over the rail, as most convenient, and taken to a good, solid, well-rounded cavil, *c*, of hard wood. The lowering-rope and the chain pendants are reciprocals of each other; that is to say, as the turns of one accumulate about the barrel, the turns of the other are expended. Hence it is easy to see that as the rope is eased away around the cavil, the weight of the boat on the chains will cause the reel to revolve, winding the rope up, giving the chain off, and lowering the bow and stern equally.

Hoisting. As soon as the boat is detached, haul on the lowering rope, and reel the chains up to the proper height. The lower block of the tackle is a single secret block with a patent sheave, and, instead of the common hook, has a ring, or jew's-harp, attached to the block by a swivel, and shaped so that the neck may be readily grasped by a man's hand. This ring, among other advantages, has the very great one of giving weight to the lower part of the block, and renders "capsizing" impossible, so that the falls are always clear. The lower block being single, time is saved in hoisting, and, as we never want for hand, the other sheave may well be spared. The friction rollers in the patent sheaves would not be permitted for the ordinary boat-falls, but as these are used for hoisting only, and do not sustain the boat for any protracted period, there is no danger of the rollers being crushed. Built in solid with the stem and stern post are the hooks A A, Figs. 393,394. In these, a man, grasping the ring by the neck, can "*snatch*" the tackles by one effort of his hand, however rough the sea, and, once *snatched*, the tongue V, contrived to fall by its own weight, confines it there, let the boat jump about as she will. Now with the boat-rope, steadying-lines, skids, &c., supposing a rough sea, the boat may be hoisted.

The Gripes consist of one long sword-mat or canvas belt, having a thimble in each end and lashed to the foot of the davits or other convenient place, and a strong ring in the bight; this is passed under the boat up outside and over, and to the ring is hooked a slip-hook (called sometimes a crane-hook), spliced in

the pendant of a gun-tackle purchase leading from the mizzen mast-head. The boat being up, pass the gripes, hook, set taut and belay the gripe-whip, and proceed to transfer the boat from her tackles to the lowering pendants, thus:

Prepare for Lowering. Open out the toggles *t*, the latch-string being slack, pass them through *r*, the rings of the pendants, and replace them in the mortises s; close up the latch *f*, set taut the latch-string *k*, and to keep it so, put in the pin T; haul on the lowering-rope to tauten up the pendants, and belay it. Now ease up the tackle falls, and when the chains have the full weight of the boat, lift the tongue V, unsnatch the rings, and the boat is again ready for lowering.

It is not necessary that the gripes should be passed in order to transfer the boat from her tackles to the chains, they are merely mentioned to render the description complete, for a vessel at sea.

NOTE. It was found that the pin T was difficult to pull out after much exposure to the weather; so, on board the practice-ship "Marion" an improvement has been attempted, by which the latch-string can be released instantly and with certainty. This is represented in Fig. 391, where T, a small pin, works on the middle of a long lever. The lever hinges on a plate on the boat's thwart, and has its upper end confined by slipping a ring over a hook. A shoulder prevents the pin T from falling below the horizontal plane when pulled out.

A board of officers, who were, by their long experience, exceedingly well qualified as judges, expressed themselves satisfied of the complete efficiency of this apparatus for the purpose designed, and did not hesitate to recommend "that it should be fitted to each quarter-boat of every sea-going vessel in the service." It was subsequently tested with six other patents and pronounced to be the best.

The captain of the "Pocahontas," who was ordered to test its merits, thus reports:

"I have no hesitation in saying that my experiments justify me in pronouncing it to be one of the best things of the kind I have ever seen, and I recommend it for all boats in the naval service. The quickest time I lowered a boat on board the "*Pocahontas*," *without any one apprehending my intention*, was as follows:

	h.	m.	s.	
"Called away the boat's crew at.....	1	57	00	P. M.
Commenced getting ready for lowering....	1	57	20	"
Ready for lowering.....	1	57	25	"
Commenced lowering.....	1	57	28	"
Boat in water (falling two feet) and detached from her tackling.....	1	57	31	"

BOATS.

The following are given as the indications of a good stroke:

1. Taking the whole reach forward and falling back gradually a little past the perpendicular, preserving the shoulders throughout square, and the chest developed to the end.

2. Catching the water and beginning the stroke with a full tension on the arms at the instant of contact.

3. A horizontal and dashing pull through the water immediately the blade is covered, without deepening in the space subsequently traversed.

4. Rapid recovery after feathering by an elastic motion of the body from the hips, the arms being thrown forward perfectly straight simultaneously with the body, and the forward motion of each ceasing at the same time.

5. Lastly, equability in all the actions, preserving full strength without harsh, jerking, isolated, and uncompensated movements in any part of the frame.*

Sculling with a single oar rigged out over the stern should also be taught.

ON THE MANAGEMENT OF OPEN ROWING-BOATS IN A SURF—BEACHING THEM, &C.

The National Life-boat Institution, England, some time since collected information from one hundred and twenty-eight different places on the coast of the United Kingdom, regarding the system of management of boats in a surf and broken water, pursued by fishermen and other coast boatmen.

It has appeared to the committee of the institution that the information obtained in this manner and in other ways may with advantage be published and circulated, for the guidance of those who may have insufficient experience in the management of boats under such circumstances.

Rules for the management of boats in a surf and broken water, naturally fall under two heads, viz.: 1st. Their management when proceeding from the shore to seaward against the direction of the surf. 2d. Their management under the opposite circumstances of running for the shore before a broken sea.

* Principles of Rowing and Steering. Slatter & Rose, Oxford, England.

BOATS—SURF.

Before stating the course to be pursued under each head, we may remark that it is an axiom almost universally acknowledged, that there is, as a general rule, far more danger when running for the shore before a broken sea, than when being propelled against it on going from the land; the danger consisting in the liability of a boat to broach-to and upset, either by running her bow under water, or by her being thrown on her beam-ends, and overturned broadside on.

RULES AND MANAGEMENT.

I. Rowing to Seaward. As a general rule, speed must be given to a boat rowing against a heavy surf. Indeed, under some circumstances, her safety will depend on the utmost possible speed being attained on meeting a sea. For if the sea be really heavy, and the wind blowing a hard, on-shore gale, it can only be by the utmost exertions of the crew that any headway can be made. The great danger then is, that an approaching heavy sea may carry the boat away on its front, and turn it broadside on, or up-end it, either effect being immediately fatal. A boat's only chance in such a case, is to obtain such way as shall enable her to pass, end on, through the crest of the sea, and leave it as soon as possible behind her. Of course, if there be a rather heavy surf, but no wind, or the wind off shore and opposed to the surf, as is often the case, a boat might be propelled so rapidly through it that her bow would fall more suddenly and heavily after topping the sea than if her way had been checked; and it may, therefore, only be when the sea is of such magnitude, and the boat of such a character, that there may be chance of the former carrying her back before it, that full speed should be given to her.

It may also happen that, by careful management under such circumstances, a boat may be made to avoid the sea, so that each wave may break ahead of her, which may be the only chance of safety in a small boat; but if the shore be flat, and the broken water extend to a great distance from it, this will often be impossible.

The following general rules for rowing to seaward may therefore be relied on:

I. If sufficient command can be kept over a boat by the skill of those on board her, avoid or "dodge" the sea if possible, so as not to meet it at the moment of its breaking or curling over.

II. Against a head gale and heavy surf, get all possible speed on a boat on the approach of every sea which cannot be avoided.

III. If more speed can be given to a boat than is sufficient to prevent her being carried back by a surf, her way may be checked on its approach, which will give her an easier passage over it.

II. Running before a Broken Sea, or Surf, to the Shore. The one great danger, when running before a broken sea, is that of *broaching-to*. To that peculiar effect of the sea, so frequently destructive of human life, the utmost attention must be directed.

The cause of a boat's broaching-to when running before a broken sea or surf is, that her own motion, being in the same direction as that of the sea, whether it be given by the force of oars or sails, or by the force of the sea itself, she opposes no resistance to it, but is carried before it. Thus, if a boat be running bow to the shore, and her stern to the sea, the first effect of a surf or roller, on its overtaking her, is to throw up the stern, and, as a consequence, to depress the bow; if she then have sufficient inertia (which will be proportional to weight) to allow the sea to pass her, she will in succession pass through the descending, the horizontal, and the ascending positions, as the crest of the wave passes successively her stern, her midships, and her bow, in the reverse order in which the same positions occur to a boat propelled to seaward against a surf.—This may be defined as the safe mode of running before a broken sea.

But if a boat, on being overtaken by a heavy surf, has not sufficient inertia to allow it to pass her, the first of the three positions above enumerated alone occurs—her stern is raised high in the air, and the wave carries the boat before it, on its front or unsafe side, sometimes with frightful velocity, the bow all the time deeply immersed in the hollow of the sea, where the water, being stationary, or comparatively so, offers a resistance, while the crest of the sea, having the actual motion which causes it to break, forces onward the stern or rear end of the boat. A boat will, in this position, sometimes, aided by careful oar-steerage, run a considerable distance until the wave has broken and expended itself. But it will often happen that, if the bow be low, it will be driven under water, when, the buoyancy being lost forward, while the sea presses on the stern, the boat will be thrown (as it is termed) end over end; or if the bow be high, or it be protected, as in some life-boats, by a bow air-chamber, so that it does not become submerged, that the resistance forward acting on one bow will slightly turn the boat's head, and the force of the surf being transferred to the opposite quarter, she will in a moment be turned round broadside to the sea, and be thrown by it on her beam-ends, or altogether capsized. It is in this manner that most boats are upset in a surf, especially on flat coasts, and in

this way many lives are annually lost among merchant seamen when attempting to land after being compelled to desert their vessels.

Hence it follows that the management of a boat when landing through a heavy surf, must, as far as possible, be assimilated to that when proceeding to seaward against one, at least so far as to stop her progress shoreward at the moment of her being overtaken by a heavy sea, and thus enabling it to pass her. There are different ways of effecting this object:—

1st. By turning a boat's head to the sea before entering the broken water, and then backing in stern foremost, pulling a few strokes ahead to meet each heavy sea, and then again backing astern. If a sea be really heavy and a boat small, this plan will be generally the safest, as a boat can be kept more under command when the full force of the oars can be used against a heavy surf than by backing them only.

2d. If rowing to shore with the stern to seaward, by backing all the oars on the approach of a heavy sea, and rowing ahead again as soon as it has passed to the bow of the boat, thus rowing in on the back of the wave; or, as is practised in some life-boats, placing the afteroarsmen, with their faces forward, and making them row back at each sea on its approach.

3d. If rowed in bow foremost by towing astern a pig of ballast or large stone, or a large basket, or a canvas bag termed a "drogue" or drag, made for the purpose, the object of each being to hold the boat's stern back and prevent her being turned broadside to the sea or broaching-to.

Drogues are in common use by the boatmen on the Norfolk coast, England; they are conical-shaped bags, of about the same form and proportionate length and breadth as a candle-extinguisher, about two feet wide at the mouth, and four and a half feet long. They are towed, with mouth foremost, by a stout rope, a small line termed a tripping-line, being fast to the apex or pointed end. When towed with the mouth foremost, they fill with water, and offer a considerable resistance, thereby holding back the stern; by letting go the stouter rope and retaining the smaller line, their position is reversed, when they collapse, and can readily be hauled into the boat.

Drogues are chiefly used in sailing-boats, when they both serve to check a boat's way and to keep her end on to the sea. They are, however, a great source of safety in rowing-boats, and many rowing life-boats are now provided with them.

A boat's sail bent to a yard and towed astern loosed, the yard being attached to a line capable of being veered, hauled, or let

go, will act in some measure as a drogue, and will tend much to break the force of the sea immediately astern of the boat.

Heavy weights should be kept out of the extreme ends of a boat; but when rowing before a heavy sea, the best trim is deepest by the stern, which prevents the stern being readily beaten off by the sea.

A boat should be steered by an oar over the stern or on one quarter when running before a sea, as the rudder will then at times be of no use.

The following general rules may, therefore, be depended on when running before, or attempting to land, through a heavy surf or broken water :—

I. As far as possible avoid each sea by placing the boat where the sea will break ahead of her.

II. If the sea be very heavy, or if the boat be small, and especially if she have a square stern, bring her bow round to seaward and back her in, rowing ahead against each heavy surf, sufficiently to allow it to pass the boat.

III. If it be considered safe to proceed to the shore bow foremost, back the oars against each sea on its approach, so as to stop the boat's way through the water as far as possible, and if there is a drogue, or any other other instrument in the boat which may be used as one, tow it astern to aid in keeping the boat head on to the sea, which is the chief object in view.

IV. Bring the principal weights in the boat towards the end that is to seaward ; but not to the extreme end.

V. If a boat worked by both sails and oars be running under sail for the land through a heavy sea, her crew should, under all circumstances, unless the beach be quite steep, take down her masts and sails before entering the broken water, and take her to land under oars alone, as above described. If she have sails only, her sails should be much reduced, a half-lowered fore-sail or other small head-sail being sufficient.

III. Beaching, or Landing Through a Surf. The running before a surf or broken sea, and the beaching, or landing of a boat, are two distinct operations : the management of boats, as above recommended, has exclusive reference to running before a surf where the shore is so flat that the broken water extends to some distance from the beach. Thus, on a very steep beach, the first heavy fall of broken water will be on the beach itself, while on some very flat shores, there will be broken water as far as the eye can reach, sometimes extending to even four or five miles from the land. The outermost line of broken water, on a flat shore, where

the waves break in three or four fathoms water, is the heaviest, and therefore the most dangerous; and when it has been passed through in safety, the danger lessens as the water shoals, until, on nearing the land, its force is spent and its power is harmless. As the character of the sea is quite different on steep and flat shores, so is the customary management of boats, on landing, different in the two situations. On the flat shore, whether a boat be run or backed in, she is kept straight before, or end on to the sea until she is fairly aground, when each surf takes her further in as it overtakes her, aided by the crew, who will then generally jump out to lighten her, and drag her in by her sides. As above stated, sail will, in this case, have been previously taken in, if set, and the boat will have been rowed or backed in by the oars alone.

On the other hand, on the *steep* beach it is the general practice, in a boat of any size, to sail right on to the beach, and in the act of landing, whether under oars or sail, to turn the boat's bow half round, towards the direction in which the surf is running, so that she may be thrown on her broadside up the beach, where abundance of help is usually at hand to haul her as quickly as possible out of the reach of the sea. In such situations, we believe it is nowhere the practice to back a boat in stern foremost under oars, but to row in under full speed, as above described.

IV. Boarding a Wreck or a Vessel under Sail or at Anchor, in a Heavy Sea. The circumstances under which life-boats or other boats have to board vessels, whether stranded or at anchor, or under way, are so various that it would be impossible to draw up any general rule for guidance. Nearly everything must depend on the skill, judgment, and presence of mind of the coxswain or officer in charge of the boat, who will often have those qualities taxed to the utmost, as undoubtedly the operation of boarding a vessel in a heavy sea or surf is frequently one of extreme danger.

It will be scarcely necessary to state that, whenever practicable, a vessel, whether stranded or afloat, should be boarded to leeward, as the principal danger to be guarded against must be the violent collision of the boat against the vessel, or her swamping or upsetting by the rebound of the sea, or by its irregular direction in coming in contact with a solid body; and as the greater violence of the sea on the windward side is much more likely to cause such accidents, the danger must, of course, also be much greater when the vessel is aground and the sea breaking over her. The chief danger to be apprehended on boarding a stranded vessel on the lee-side, if broadside to the sea, is the

falling of the masts; or if they have been previously carried away, the damage or destruction of the boat among the floating spars and gear alongside. It may, therefore, under such circumstances, be often necessary to take a wrecked crew into a life-boat from the bow or stern; otherwise a rowing-boat, proceeding from a lee-shore to a wreck, by keeping under the vessel's lee, may use her as a breakwater, and thus go off in comparatively smooth water, or at least shielded from the worst of the sea. This is, accordingly, the usual practice in the rowing life-boats around the United Kingdom. The larger sailing life-boats, chiefly on the Norfolk and Suffolk coasts, which go off to wrecks on outlying shoals, are, however, usually anchored to windward of stranded vessels, and then veered down to one hundred or one hundred and fifty fathoms of cable, until near enough to throw a line on board. The greatest care, under these circumstances, has, of course, to be taken to prevent actual contact between the boat and the ship; and the crew of the latter have, sometimes, to jump overboard, and to be hauled to the boat by ropes.

In every case of boarding a wreck or a vessel at sea, it is important that the lines by which a boat is made fast to the vessel should be of sufficient length to allow of her rising and falling freely with the sea, and every rope should be kept in hand ready to cut or slip in a moment, if necessary. On wrecked persons or other passengers being taken into a boat in a sea-way, they should be placed on the thwarts in equal numbers on either side, and be made to sit down, all crowding and rushing headlong into the boat being prevented as far as possible; and the captain of the ship, if a wreck, should be called on to remain on board her to preserve order until every other person shall have left the ship.

PRACTICAL HINTS FOR THE CONSIDERATION AND GUIDANCE OF SEAMEN AND OTHERS HAVING CHARGE OR COMMAND OF BOATS.

I. Acquire the habit of sitting down in a boat, and never stand up to perform any work which may be done sitting.

II. Always step at once into the 'midships of a boat in getting into one, and never on the gunwale.

III. Never climb the mast of a boat, even in smooth water, to reeve halliards, or for any other purpose, but unstep and lower the masts in preference. Many boats have been upset, and very many lives lost from this cause. The smaller the boat, the more necessary this and the foregoing precaution.

IV. All spare gear, such as masts, sails, oars, &c., which are stowed above the thwarts, should be lashed close to the sides of a boat; and any heavy article on the boat's floor be secured as well as possible, amidships, to prevent them all falling to leeward together on a heavy lurch of the sea.

V. On a merchant vessel getting stranded or otherwise disabled in a heavy sea, or on an open coast where there is a high surf on the beach, the crew should remain by the vessel as long as they can safely do so, in preference to taking the boats. As a general rule, much more risk is incurred in a boat than in a ship, so long as the latter will hold together. Indeed, in a moderate wind, on a lee-shore in open situations, and even in a calm, there is frequently more surf than an ordinary ship's boat can, with safety, attempt, however well managed she may be.

VI. After being compelled to desert a ship in an ordinary ship's boat, too great precaution cannot be taken before attempting to land. Viewed from seaward, a surf has never so formidable an appearance as when seen from the land; persons in a boat, outside the broken water, are, therefore, apt to be deceived by it. They should accordingly, if practicable, proceed along the land outside the surf, until abreast of a coast-guard or life-boat station, or fishing-village, whence they might be seen by those on shore, who would then signalize to them where they might most safely attempt to land, or warn them to keep off; or who might proceed in a life-boat or fishing-boat to their aid; the generality of coast fishing-boats being far better able to cope with a surf than a ship's boat, and the coast-boatmen being more skilful in managing boats in a surf than the crews of ships. If in the night, double precaution is necessary, and it will in general be much safer to anchor a boat outside the surf until daylight than attempt to land through it in the dark. For this reason, an anchor and cable should always be put into a boat before leaving the ship, and also two or three buckets, in addition to the baler or hand-pump, which should always be kept in her, so that she might be quickly relieved of any water she might ship.

VII. Boats may ride out a heavy gale in the open sea, in safety, if not in comfort, by lashing their spars, oars, &c., together, and riding to leeward of them, secured to them by a span. The raft thus formed will break the sea; it may either be anchored or drifting, according to circumstances.

If the boat has a sail, the yard should be attached to the spars with the sail loosed. It will break much sea ahead. Also a weight suspended to the clew of the sail will impede drift when requisite. In all cases of riding by spars, not less than two oars

should be retained in the boat, to be ready for use in case of parting from the spars.

VIII. Where surf breaks at only a short distance from the beach, a boat may be veered and backed through it, from another boat anchored outside the surf, when two or more boats are in company; or she may be anchored and veered, or backed in from her own anchor.

IX. Ship's boats should, in addition to their oars, masts, and sails, have the following articles kept in them when at sea, or, if not in them they should be placed in them, if possible, before deserting a ship at sea:

A baler or hand-pump, and buckets; the plug, and a spare one, both fastened by laniards; spare thole-pins and grommets, if rowed in that manner; two or three spare oars; a small hatchet; an anchor and cable; a long small line, as a whale-line or deep-sea lead-line, and any life-buoys or life-belts which are on board. If in the night, or at a distance from the land, a lantern and matches, and, if available, blue-lights or hand-rockets. If beyond sight of land, a compass and telescope, and, of course, fresh water and provisions. A log-line and sand-glass, a hand-lead and line, small arms and ammunition (with ball-cartridges and small shot). A red flag and a boat-hook for a flag-staff might often be useful to attract attention. A red flannel shirt is a good substitute for a flag.

X. In addition to the above, small empty casks or breakers, tightly bunged and lashed beneath the thwarts, would partially convert any boat into a life-boat, by making it impossible for her to founder; and by leaving less space to be occupied by water if filled by a sea, their use would much expedite the process of pumping or baling out.

XI. No ship's boat should either be lowered into or hoisted from the water without first having a rope from the forepart of the ship made fast to her bows, by which means she will be much steadied, and will be prevented going adrift if the tackles should be prematurely unhooked or carried away. The rudder should be slung, to prevent its being lost if accidentally unshipped.

INSTRUCTIONS FOR SAVING DROWNING PERSONS BY SWIMMING TO THEIR RELIEF.

The following instructions, taken from the Journal of the Life-boat Institution, England, are for those who, being good swimmers themselves, go to the rescue of drowning persons. The writer, from his long experience, and frequent successful efforts in rescuing persons from drowning, by swimming to their aid, is

considered fully competent to give the most reliable information on the subject.

1st. When you approach a person drowning in the water, assure him, with a loud and firm voice, that he is safe.

2d. Before jumping in to save him, divest yourself, as far and as quickly as possible, of all clothes; tear them off, if necessary, but if there is not time, loose, at all events, the foot of your drawers, if they are tied, as, if you do not do so, they will fill with water and drag you.

3d. On swimming to a person in the sea, if he be struggling, do not seize him then, but keep off for a few seconds till he gets quiet, for it is sheer madness to take hold of a man when he is struggling in the water, and if you do, you run a great risk.

4th. Then get close to him and take fast hold of the hair of his head, turn him as quickly as possible on his back, give him a sudden pull and this will cause him to float, then throw yourself on your back also and swim for the shore, both hands having hold of his hair, you on your back and he also on his, and, of course, his back to your stomach. In this way you will get sooner and safer ashore than by any other means, and you can easily thus swim with two or three persons; the writer has often, as an experiment, done it with four, and gone with them forty or fifty yards in the sea. One great advantage of this method is, that it enables you to keep your head up, and also to hold the person's head up you are trying to save. It is of primary importance that you take fast hold of the hair, and throw both the person and yourself on your backs. After many experiments, I find this vastly preferable to all other methods. You can, in this manner, float nearly as long as you please, or until a boat or other help can be obtained.

5th. I believe there is no such thing as a death-*grasp*, at least it must be unusual, for I have seen many persons drowned, and have never witnessed it. As soon as a drowning man begins to get feeble and to lose his recollection, he gradually slackens his hold until he quits it altogether. No apprehension need therefore be felt on that head when attempting to rescue a drowning person.

6th. After a person has sunk to the bottom, if the water be smooth, the exact position where the body lies may be known by the air-bubbles which will occasionally rise to the surface, allowance being, of course, made for the motion of the water, if in a tide-way or stream, which will have carried the bubbles out of a perpendicular course in rising to the surface. A body may be

RESTORING THE APPARENTLY DROWNED.

often regained from the bottom before too late for recovery, by diving for it in the direction indicated by these bubbles.

7th. On rescuing a person by diving to the bottom, the hair of the head should be seized by one hand only, and the other used, in conjunction with the feet, in raising yourself and the drowning person to the surface.

8th. If in the sea, it may sometimes be a great error to try to get to land. If there be a strong "outsetting" tide, and you are swimming either by yourself or having hold of a person who cannot swim, then get on your back and float till help comes. Many a man exhausts himself by stemming the billows for the shore on a back-going tide, and sinks in the effort, when, if he had floated, a boat or other aid might have been obtained.

9th. These instructions apply alike to all circumstances, whether the roughest sea or smooth water.

JOSEPH R. HODGSON.

SUNDERLAND, *Dec.*, 1858.

DIRECTIONS FOR RESTORING THE APPARENTLY DROWNED.

Send immediately for medical assistance, blankets, and dry clothing, but proceed to treat the patient *instantly* on the spot, in the open air, whether on shore or afloat.

The points to be aimed at are, *first* and *immediately*, the RESTORATION of BREATHING and the PREVENTION of any further DIMINUTION of the WARMTH of the BODY; and *secondly*, after *breathing* is *restored*, the PROMOTION of WARMTH and CIRCULATION.

The efforts to *restore breathing*, and to *prevent* any further *diminution* of the *warmth* of the *body*, must be commenced immediately and energetically, and must be persevered in for several hours, or until a medical man has pronounced that life is extinct. Efforts to promote *warmth* and *circulation* must be deferred until natural breathing has been restored.

To RESTORE BREATHING.

To clear the Throat—

1. Place the patient face downward, with one of his arms under the forehead, in which position all fluids will escape by the mouth, and the tongue itself will fall forward, leaving the entrance into the windpipe free. Assist this operation by wiping and cleansing the mouth.

2. If there be only slight breathing, or no breathing, or if it fail, then—

RESTORING THE APPARENTLY DROWNED.

To excite Breathing—

3. Turn the patient well and instantly on the side, and—

4. Excite the nostrils with snuff, hartshorn, smelling-salts, or the throat with a feather, &c., if they are at hand. Rub the chest and face warm, and dash cold water on it.

5. If there be no success, lose not a moment, but instantly—

To imitate Breathing—

6. Replace the patient on the face, raising and supporting the chest well upon on a folded coat or other article of dress.

7. Turn the body very gently on the side and a little beyond, and then briskly on the face back again, repeating these measures deliberately, efficiently, and perseveringly, about fifteen times in the minute, or once every four seconds, occasionally varying the side.

[*By placing the patient on the chest, the weight of the body forces the air out; when turned on the side, this pressure is removed, and air enters the chest.*]

On each occasion that the body is replaced on the face, make uniform but efficient pressure, with brisk movement on the back, between and below the shoulder-blades or bones on each side, removing the pressure immediately before turning the body on the side.

[*The first measure increases the expiration, the second commences inspiration.*]

*** The result is *respiration* or *natural breathing*, and—if not too late—*life*.

Cautions—

1. Be particularly careful to prevent persons crowding round the body.

2. Avoid all rough usage and turning the body on the back.

3. Under no circumstances hold the body up by the feet.

TO PREVENT ANY FURTHER DIMINUTION OF WARMTH.

N. B.—These efforts must be made very cautiously, and must not be such as to promote *warmth* and *circulation rapidly*; for if circulation is induced before breathing has been restored, the life of the patient will be endangered. No other effect, therefore, should be sought from them than the prevention of evaporation and its result, the diminution of the warmth of the body.

RESTORING THE APPARENTLY DROWNED.

1. Expose the face, neck, and chest, except in severe weather such as heavy rain, frost, or snow.

2. Dry the face, neck, and chest, as soon as possible, with handkerchiefs or anything at hand, and then dry the hands and feet.

3. As soon as a blanket or other covering can be obtained, strip the body; but if no covering can be immediately procured, take dry clothing from the bystanders, dry and reclothe the body, taking care not to interfere with the efforts to restore breathing.

Cautions—

1. Do *not* roll the body on casks.

2. Do *not* rub the body with salt or spirits.

3. Do *not* inject tobacco smoke or infusion of tobacco.

4. Do *not* place the patient in a warm bath.

TREATMENT AFTER NATURAL BREATHING HAS BEEN RESTORED, TO PROMOTE WARMTH AND CIRCULATION.

1. Commence rubbing the limbs upwards, with firm, grasping pressure and energy, using handkerchiefs, flannels, &c. [*By this measure the blood is propelled along the veins towards the heart.*]

The friction must be continued under the blanket, or over the dry clothing.

2. Promote the warmth of the body by the application of hot flannels, bottles or bladders of hot water, heated bricks, &c., to the pit of the stomach, the armpits, between the thighs, and to the soles of the feet.

3. If the patient has been carried to a house after respiration has been restored, be careful to let the air play freely about the room.

4. On the restoration of life, a teaspoonful of warm water should be given; and then, if the power of swallowing have returned, small quantities of wine, warm brandy-and-water, or coffee, should be administered. The patient should be kept in bed, and a disposition to sleep encouraged.

GENERAL OBSERVATIONS.

The above treatment should be persevered in for several hours, as it is an erroneous opinion that persons are irrecoverable be-

cause life does not soon make its appearance, cases having been successfully treated after persevering for many hours.

Appearances which generally Accompany Death.

Breathing and the heart's action cease entirely; the eyelids are generally half-closed, the pupils dilated, the jaws clenched, the fingers semi-contracted; the tongue approaches to the under edges of the lips, and these, as well as the nostrils, are covered with a frothy mucus. Coldness and pallor of surface increase.*

* The leading principles of the above instructions are those of the late Dr. Marshall Hall for the Restoration of the Apparently Dead from Drowning, and are the results of the latest discoveries. The favorable opinion of the principal medical bodies, and of three hundred medical men in this country (England), as also those of the chief medical bodies on the Continent, have been obtained by the Royal National Life-Boat Institution on the subject.

CHAPTER XIX.

RULES CONCERNING LIGHTS,* ETC.

STEAM-VESSELS.

All sea-going steam-vessels, when under steam, shall, between sunset and sunrise exhibit the following lights:

1. A bright White light at the foremast head.

A Green light on the starboard side.

A Red light on the port side.†

2. The mast-head light shall be so constructed as to be visible on a dark night with a clear atmosphere, at a distance of at least five miles, and shall show a uniform and unbroken light over an arc of the horizon of twenty points of the compass, and it shall be so fixed as to throw the light ten points on each side of the ship, viz.: from right ahead to two points abaft the beam on either side.

3. The Green light on the starboard side, and the Red light on the port side, shall be so constructed as to be visible on a dark night, with a clear atmosphere, at a distance of at least two miles, and show a uniform and unbroken light over an arc of the horizon of ten points of the compass, and they shall be so fixed as to throw the light from right ahead to two points abaft the beam on the starboard and port sides, respectively.

4. The lights are to be fitted with inboard screens projecting at least three feet forward from the light, so as to prevent the lights from being seen across the bow.

5. Steam-vessels, under sail only, are not to carry their mast-head light.

FOG SIGNALS.

Whenever there is a fog, whether by day or night, the fog-signals described below shall be carried and used, and shall be sounded at least every five minutes, viz.:

Steamships under way shall use a steam-whistle, placed before the funnel, not less than eight feet from the deck.

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* See United States Navy Regulations.

† Knowing that Port (wine) is red, the side lights may be easily remembered.

CONCERNING LIGHTS.

Sailing ships under way shall use a fog-horn.

Steamships and sailing ships, when not under way, shall use a bell.

SAILING VESSELS.

All sea-going sailing vessels, when under way or being towed, shall, between sunset and sunrise, exhibit a Green light on the starboard side, and a Red light on the port side of the vessel.

VESSELS AT ANCHOR.

All sea-going vessels, when at anchor in roadsteads or fairways, shall, between sunset and sunrise, exhibit, where it can best be seen, but at a height not over twenty feet above the hull, a White light in the globular lantern of eight inches in diameter, and so constructed as to show a clear, uniform, and unbroken light all round the horizon, at a distance of at least one mile.

RULES OF THE ROAD.

When vessels shall be crossing each other on different tacks, and there shall be any doubt which can pass to windward with perfect safety, the ship on the *starboard* tack shall keep her wind, and the vessel on the *port* tack shall keep away, *without any regard being paid to rank of the respective commanders.*

Vessels going with the wind free, always to give way to those by the wind.

Vessels under steam alone shall always give way to sailing vessels.

All vessels are to bear up, shorten sail, steam slower, or back in such manner as may be most convenient to prevent collision.

Although the foregoing directions of the Navy Department are only imperative on board vessels of the navy, yet, as a general rule, all the sea and other steamers of the United States conform to them.

The British, French, Netherlands and Russian governments, have issued orders requiring *all the vessels sailing or steaming* under their respective flags, to carry the lights and conform strictly to regulations of similar tenor to those contained in the United States Navy Regulations of 1865.

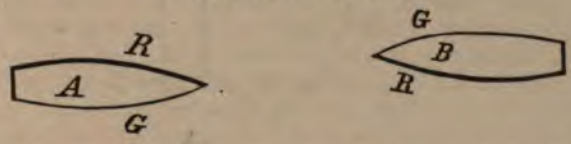
The following diagrams and illustrations may be useful for reference. The letter *G* will signify a *green* light, and *R* a *red* light.

CONCERNING LIGHTS.

FIRST SITUATION.

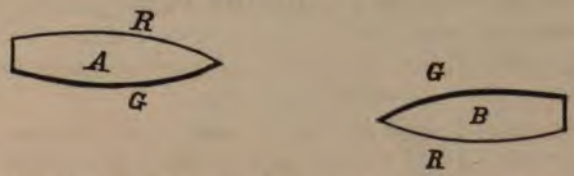
In this situation, the two colored lights visible to each vessel, will indicate their *direct* approach head on. The general if not the universal rule, in this case is, for BOTH VESSELS TO PUT THEIR HELMS TO PORT.

SECOND SITUATION.



In this situation the vessels placed as *A* and *B* will see the Red light only, of each other, the screens hiding the *green* lights from that point of view, showing them that they are passing to *port*; but if in any doubt as to the distance they would pass, by continuing their course, both should *port* their helm until out of all danger of collision.

THIRD SITUATION.



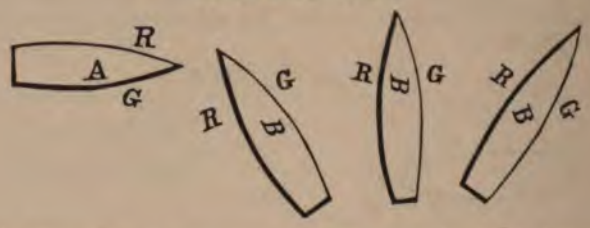
With *A* and *B* in this position, the *green* light only of each vessel will be seen, showing that they are passing to *starboard*. The precaution, to give a good berth in passing, should be taken, by putting the helms of both vessels to *starboard*, until out of all danger of collision.

FOURTH SITUATION.

CONCERNING LIGHTS.

In this situation, A will see B's Green light only, which will clearly show that B is crossing to starboard of A, either perpendicular to A's course, or obliquely to it. B will, as he approaches the line of A's course, see A's Red light, and as he passes ahead will open both colored lights, as well as the White (mast-head) light (if a steamer), indicating that A is steering *directly* towards him.

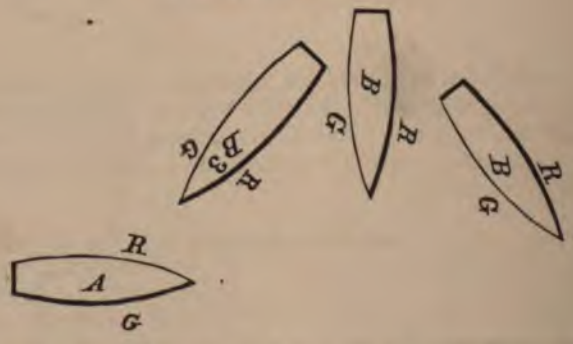
FIFTH SITUATION.



In this situation, the steamer A will see *only the Red light* of the steamer B, in either of the three positions she may be in. A will know that the *Port side* of B is towards him, and that B is crossing the bows of A in *some direction to port*. Under these circumstances A should *port his helm* without hesitation, to give B a good berth in passing.

In either of the positions of B in the fifth diagram, he will see the *Green, White, and Red lights* of A in a triangular shape (if a steamer), which will show B clearly that A is approaching *directly towards him*, and he should act promptly to guard against a collision.

SIXTH SITUATION.

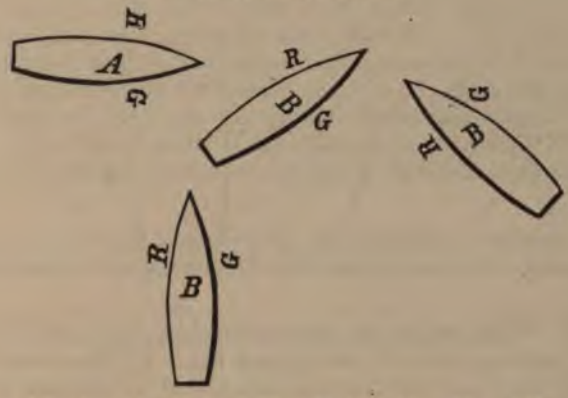


In this situation A will see a *Green light* on the bow, or nearly ahead. If A sees a *White mast-head light* at the same time, he knows that it is a steamer, and that she is either approaching

CONCERNING LIGHTS.

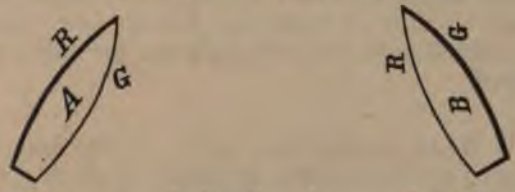
him on the port bow, as in situation B 3, or crossing his bows to starboard perpendicularly to his line of course, or obliquely from, or obliquely towards him. B will see, first, A's *Red light*, and after drawing ahead his *White* (mast-head) *light* also, if a steamer.

SEVENTH SITUATION.



In this situation A will see B's *Red light*, and will know that B's *port* side is nearest to him, and therefore that B is passing across his bows *to port*. If A should see B's *White mast-head light* at the same time that he sees the *Red light*, he will know that it is a steamer, and is passing either *directly* or obliquely across his bows. If he sees the *Red light only*, he will know that B, if a steamer, is passing to port of the line perpendicular to his course.

EIGHTH SITUATION.



This is a very common situation for vessels to be placed in at sea, and one demanding great caution and watchfulness. A sees B's *Red light* and White (mast-head) light, if a steamer. B sees A's Green light and White (mast-head) light, if a steamer, which will show them that they are approaching each other. This is a case for which no general or certain rule can be laid down. Circumstances must be considered at the time, and they must be the guide in acting.

RULES OF THE ROAD.

Rule as to vessels passing each other in channel ways.—Whenever any vessel proceeding in one direction, meets a vessel proceeding in another direction, and the master or person having charge of either such vessels perceives, that, if both vessels continue their respective courses, they will pass so near as to involve a risk of collision, he shall put the helm of his vessel to port, so as to pass on the port side of the other vessel, due regard being had to the tide, and to the position of each vessel with respect to the dangers of the channel, and, as regards sailing vessels, to the keeping of each vessel under command; and the master of any steam-vessel navigating any river or narrow channel, shall keep as far as practicable to that side of the fairway or mid-channel thereof which lies on the starboard side of each vessel.

As it is often necessary and convenient to violate the above, the following additional rules have been adopted in the merchant service:

RULE I. When steamers are approaching each other, the signals for passing shall be *one* sound made by the steam-whistle to keep to the *right*, and *two* sounds made by the steam-whistle to keep to the *left*, and these signals shall be observed by all steamers, whether by night or by day; and if in a current, the *ascending boat shall sound the whistle first*, and the descending boat shall answer.

RULE II. Should steamers be likely to pass near each other, and these signals should not be made and answered by the time such boats shall have arrived at the distance of eight hundred yards from each other, the engines of both boats shall be stopped; or should the signal be given and not properly understood from any cause whatever, both boats shall be backed until their headway shall be fully checked, and the engines shall not be again started ahead until the proper signals are made, answered, and understood.

. . . . . .

RULE VIII. When steamers are running in the same direction, and the pilot of the boat which is astern shall desire to pass either side of the boat ahead, he shall give the signal as in Rule I., and the pilot of the boat ahead shall answer by the same signal and allow the other to pass on the side selected, and shall in no case attempt to cross her bow or crowd upon her course.

. . . . . .

RULE X. Doubts or fears of misunderstanding signals may be expressed by several short sounds of the whistle in quick succession.

CONCERNING BUOYS.

Channel Buoys. In conformity to the terms of an act of Congress, approved Sept. 28, 1850, relative to channel buoys, &c., the following will be observed, viz. :

1. In approaching the channel, &c., from seaward, *Red Buoys* with even numbers will be found on the *Starboard* side of the channel, and must be left on the *Starboard* hand when passing in.

2. In approaching the channel, &c., from seaward, *Black Buoys* with odd numbers will be found on the *Port* side of the channel, and must be left on the *Port* hand when passing in.

3. *Buoys* painted with *Red* and *Black Stripes* will be found on obstructions, with channel-ways on either side of them, and may be left on either hand when passing in.

4. Buoys painted with *White* and *Black perpendicular stripes* will be found in *mid-channel*, and must be passed close to avoid danger.*

* Blunt's Coast Pilot, page 219 (20th Edition).

CHAPTER XX.

BENDING AND UNBENDING SAILS—LOOSING AND FURLING—CROSSING TOP-GALLANT YARDS—SQUARING YARDS, ETC.

The Trumpet.* In the preceding chapters, the endeavor has been made to present the prominent features of the method of fitting out a ship for sea. We have now arrived at that part of the course where the young officer may be supposed to take charge of the deck, and, in preparing for this responsible duty, it will be well for him beforehand to settle, in his own mind, on some definite line of conduct, so that he may be consistent, dignified, self-possessed, and zealous; or, wanting these virtues, he may affect them.

The regularity and precision of military movements are not suited to a ship's decks, nor are the commands for the various evolutions to be laid down with the exactness given in works on military tactics; but it will be found that those officers who give their orders in accordance with the time-honored customs of the service, so familiar to all men-of-war's men, and in a tone and manner which command attention and inspire respect, will, all else being equal, get more work out of a ship's company, and get it done with far greater spirit and alacrity, than those who coin expressions for the occasion, and issue their orders as if obedience were doubtful or indifferent to them.

Commands. The commands are of three kinds: first, the *preparatory command*, which indicates what is to be done; as *Ready about! Get the starboard stun' sails ready for setting!* &c. Second, the command of *caution*, which elicits immediate attention, and which is quickly followed by the third—the order of *execution*; as *Haul taut!* WALK AWAY! *Haul well taut!* LET GO AND HAUL! in tacking. *Set taut!* HOIST AWAY! when setting studding sails, hoisting boats, &c., *Stand by!* SWAY! or, SWAY ACROSS! in sending up or down topgallant or royal yards. *Stand by!* LET FALL! in

*It is customary at sea for the officer of the watch to carry a speaking-trumpet. This is done, not only that he may have an auxiliary, often necessary to the voice, but also that he may be readily distinguished as the one, for the time being, responsible for the safety of the ship.

In port there is no such distinctive mark sanctioned by general use; though a few of our ships have adopted the spy-glass for the purpose. As an officer of the deck should be constantly on the look out this is an exceedingly appropriate insignia of his office, and the custom bids fair to become general.

BENDING SAILS.

loosing sail. (The first or cautionary order is printed in *italics*, the latter, or order of execution, in SMALL CAPITALS.)

Orders should be given in a tone of voice modulated to suit the occasion; and delivered, particularly the preparatory command, in a clear *deliberate* and distinct tone, *with full emphasis*, and to this end, when using the trumpet, place it so that the least concave arc of the mouth-piece may rest against the upper lip, while the greater is below and gives room for the play of the lower lip.

The commands of caution, *haul taut*, and *stand by*, are absolutely essential when working a number of men (as a watch, or *all hands*, for instance), for it is not possible without such commands to get them to exert themselves at the same instant, as they should do.

The preparatory order, if given deliberately, will be better understood, though it should not be uttered without due energy. The cautionary order should be sharp, quick, and full of energy, while that of execution should be distinct and emphatic.*

Commands may sometimes be *omitted* with good effect. For example, when crossing yards or loosing sails, at the hoisting of the colors, beating the "call" by the drum is in itself a sufficient signal for the men to "lay aloft," and the order becomes entirely superfluous.

So the "third roll" is sufficient to indicate the moment to "sway across" or to "let fall," and dispenses with the command.

It is customary to give the cautionary order, *Stand by to sway (sway across, let fall, hoist away, &c., &c.) at the third roll!* but even this after a little practice is entirely unnecessary.

By the avoidance of unnecessary commands, and the substitution of signs and signals for verbal orders, when practicable, the quiet of a vessel is materially promoted.

When conning steamers going in or out of port, signs to the helmsman are much better than the usual verbal orders.

BENDING SAILS.

The method of making up and bending sails, given in the chapter on sails (Chap. XI.), is in accordance with the practice of the service; but there is good authority for recommending that the sail should be made up for bending *as furled;* and when the reefing beckets and toggles are used the *gaskets* may be sewed

* Orders should not be given prematurely or before the men can possibly get ready to obey; for example, when furling sails, the order, *Lay out!* should not be given while the top-men are still going over the futtock rigging. This kind of haste is not uncommon with young officers. The opposite extreme, viz., too much deliberation, is even more to be avoided.

to the head of the sail, instead of being attached to the jackstay on the yard. This last is no doubt a decided improvement, in some respects.

That the different methods may be tried on board the practice-ships and a fair comparison instituted, the plan above stated will be briefly described and a few additional suggestions given.

Preparations for Bending. (*2d Method.*) All the square sails may be fitted with gaskets; seize them on the head at equal distances; make the laniards a fathom long; and put marks with knots, so that when hailing the yard from the deck the gasket alluded to can be denoted by its number from the bunt.

By tying sails up with temporary fastenings, there is not only great waste of spun yarn, but injury done; for ignorant hands always cut *at* the sail in cutting loose, instead of entering their knife and cutting towards themselves.

There can be no question about the superior neatness and efficiency of making it a habit to send sails, both up and down, made up just as if furled. Indeed, when blowing strong at anchor head to wind there is no alternative.

In making them up, the main point to aim at is keeping the yard-arms as light as possible, so that the sail may haul out taut all along more easily. Send down the light yards, and stop the yard ropes out of the way.

Seize the sail straps to the heads of the sails at the middle eyelet holes; *let them always remain there*, and when using them after the sail is rolled up, carry the foremost leg round the after one, and seize its bight to its own parts. Top-men are very apt to cut this seizing too soon; but by having the strap fast to the head, their mistake may be partly remedied by a pull on the sail tackle, which is always hooked to the after leg.

Topsails. Haul the head of the topsails along the deck after sides downward; gather all the slack canvas back from the head; lay the second reef band along the head, and haul this and the head taut fore and aft by the earings. Bring the leeches as far as the reef tackle cringles along the head; knot the fourth reef earing into the third reef cringle, and the third into the second; carry the clues into the quarters about six feet over the head; bring the buntline toggles about a foot over the head between the clues; coil all the remainder of the roping so as not to ride, leaving the bowline cringles out; face the foot and gather up; then face the head and roll up; pass the gaskets taut; stop the clues up abaft the head after having passed them over the fore part of the bunt; seize the strap; hook the sail tackle; knot the *second* reef earing into the first reef cringle, the first into the head;

and stop the head earings along the top of the sail on each side. Send the buntlines down on the same side of the lower stay with the sail tackle. Toggle them, and then hitch their bights round the quarters of the sail on their own sides about a fathom outside the strap. Bend a bowline of the side to the strap of the sail tackle block to guy it off the top rim; though if the fall is led through a block tailed to the strap and led well forward to act as a travelling jack-stay, the bowline will not be needed. Overhaul the sheets, clew-lines, and reef tackles into the top.

Man the burtons!

The fall, having a fair lead, is manned, having one hand to tend the stopper and one to belay. A few hands to the buntlines to keep them taut and belay.

Haul taut! SWAY ALOFT!

When the clews of the sail have been swayed above the top rim, and the turns slewed out—

High enough!

Take a turn with sail tackle fall and buntlines. Bend the reef tackles to the second reef cringles and when ready—

SWAY HIGHER!

Keep a good strain on the buntlines as the sail tackle is lowered on, hauling the reef tackles out. If the quarters are allowed to get below the yard, they are not easily raised.

Stand by to lay aloft topmen! LAY ALOFT!

Man the boom tricing-lines and reef-tackles!

TRICE UP, HAUL OUT! LAY OUT AND BRING TO!

Carry the head earings out to the yard-arms; haul the head of the sail taut along the yard; tie the robands; lash the clue lines; shackle the sheets; bend the reef tackle to its proper cringle; toggle the bowlines; cast the hitch off the buntlines and the seizing off the strap; toss the sail up, &c., or set it to ascertain if all the gear is properly bent. In all cases where the reef-tackles will not answer, yard-arm jiggers must be put on for the express purpose of hauling out the head of the sail.

Courses. Haul the heads of the courses taut along, roping downwards (i. e. after sides on the deck) on top of the sail strap, and make the earings fast. Gather the sail back from the head, and then lay the second reef-band on the head, hauling its earings also taut out. Bring the leeches in taut, as far as the inner leech line cringle, and lay them on the head. Lay the clues over the head, about six feet on each side of the middle of

BENDING SAILS.

the sail, and the buntline toggles about a foot over the head between them. Place the men along the head, and gather up as in furling; throw the skin over; let the men step across, and roll up; pass the gaskets, footing them well taut; let go the earings, coil and stop them up. Now stretch the sail across the deck forward of its mast, and under its yard. Send the ready-men aloft and let them overhaul down and proceed to bend the gear. Pass the foremost leg of the strap over the bunt of the sail, round the after leg of the strap, and seize its bight to its own part. Make the stay-whip fast well up on the slings, and hook on to the after leg of the sail strap. Sway the sail up and down, till its after part is aft, and when clear of turns, hook the reef-tackles to the second reef-cringle *over the tacks and sheets*, and haul the arms out to the sides, lowering the whip sufficiently to bend the buntlines, leech-lines, tacks, sheets, and clue-garnets. Hang the clues to the strap of the whip-block before the bunt of the sail.

Get the distance of each leech-line block on the yards *from the slings* with a piece of line, and rack the leech-lines to the head of the sail, *exactly* at those distances from the middle of the sail, taking care that the leech-lines are clear of each other and the inner one racked inside the outer.

Overhaul the clue-garnets, and tacks, and sheets, well. Trice booms up, sway the courses close up with the stay-whips, and proceed as with the topsails, using the commands—

Stand by to lay aloft lower-yard-men!

LAY ALOFT!

Man the boom tricing-lines! &c., as before.

If the leech-lines have been racked just under each leech-line block, the courses will haul taut along the yard, so that two hands might bend the courses. Round up the clue-garnets, "bring to" the head of the sail, cut the seizings of the setting strap, leaving the strap on the head, pass the laniards of the gaskets round the jack-stays.

It will prevent many vexatious mistakes if the courses are marked at the bending places of the different gear, with a piece of duck sewn on the sail, bearing the initials of the rope which should be made fast there (thus, S. I. L., starboard inner leech-line, and so on), and also to plait some bunting into the robands at these places; for in sending courses up furled, nothing will go well unless the leech-lines be fast to the head of the sail *exactly under* their own blocks which are on the yard.

This and similar suggestions apply to those cases only where bending and unbending are of frequent occurrence for the purpose of exercise.

TO BEND SAIL.

Having described the manner of bending in detail, the following will be the commands to bend all sail together under ordinary circumstances, in port.

The topsails, courses, jib, and spanker, are generally bent together. The *ready-men* being aloft, the sails properly made up, sail-tackles hooked and led out, and gear bent, order the boatswain to call, *All hands bend sail!* and when the men are reported up—

Man the sail-tackles and buntlines—Jib-halliards!

Haul taut! SWAY ALOFT!

At the last order walk the topsails up, and as soon as they are well clear of the deck, start up the courses. The yard-arm jiggers and lower leech-lines should not be touched, the sails hanging directly up and down the masts, by the burtons and buntlines. When high enough,

A turn with the burtons!

Stand by to lay aloft! And when ready—

ALOFT TOPMEN! *Lower yard-men on the sheer-pole!*

ALOFT LOWER YARD MEN!

Man the boom tricing-lines, yard-arm jiggers, and leech-lines!

TRICE UP! HAUL OUT! LAY OUT AND BRING TO!

Having hands to tend the burton-falls and buntlines, all the rest of the men on deck go to the yard-arm jiggers and leech-lines, and at the order the sails all go out together.

The jib is sent out as the other sails go aloft, and the spanker is brought to the gaff, and the gaff hoisted as the hoops are seized to the luff of the sail.

If the sails are new, or the ship going to sea immediately, they should be set, to see that the gear is properly bent. This operation is generally confined to the topsails, and the following are the commands—the sails being bent:

Stand by the boom tricing-lines!

LAY IN! DOWN BOOMS! LAY DOWN FROM ALOFT!

Man the topsail sheets and halliards!

Let go and overhaul the rigging—tend the topsail braces!

Haul taut! SHEET HOME AND HOIST AWAY THE TOPSAILS!

Or, after bending, the sails may be left to air, in which case haul the clews and buntlines up square, and order—

BENDING SAIL IN PORT.

Lay in! LAY DOWN FROM ALOFT!

If the sails are to be furled at once, order—

Stand by to furl! And when ready—

FURL AWAY!

Stand by the booms!

Lay in! DOWN BOOMS! LAY DOWN FROM ALOFT!

As soon as the sails are bent, order—

Stand by to send down the burtons and jiggers!

LOWER AWAY TOGETHER! And see that that they all come down together.*

The light sails are generally bent immediately after the others, to do which, give the order—

Stand by to bend the light sails!

At this the yards are got ready for getting out of the rigging, and the flying jib prepared for going out; when ready—

Man the top-gallant and royal yard ropes!

Haul taut! SWAY OUT OF THE CHAINS!

And when clear of the hammock nettings—

LOWER AWAY TOGETHER!

The sails are bent and neatly furled, with the clews in; the yard-ropes hooked and manned; the flying-jib halliards, downhaul and marrying-line of flying-jib-stay also manned; order—

Man the yard-ropes—flying-jib halliards!

Haul taut! SWAY OUT TOGETHER!

When placed in the rigging the bunts of the light sails should be slewed out-board.

On board large ships, it is convenient to get these yards in and out of the rigging with the clew jiggers.

Making Sail after Bending. After bending it is well to make all sail and move the yards about, getting braces, buntlines, &c., marked to avoid unnecessary noise in shortening sail, furling, squaring yards, &c.

In sheeting home topsails, if the sheet is double, both parts may be stopped together, having hands outside the lifts to cut the stops as they come out.

* When preparing to bend sail, if yard-arm jiggers are used, they should all go out together at the order, *Lay out!* and not be permitted to be placed one at a time, as they get ready.

FURLING SAILS.

Men should be warned in off the quarter of the lower yards, as the fall of the topsail is very heavy and violent.

Hands should be stationed to *ease away* the topsail clew-lines as the sheets are hauled home.

TO FURL SAILS—PORT ROUTINE.

Generally speaking, when sails have been loosed, the captains of the tops manage to pass in the leeches for furling, and arrange the back-cloths, if they are allowed; but this should not be permitted. Call—

All hands furl sails! And if the light sails are aloft—

ALOFT TOP-GALLANT AND ROYAL-YARD MEN! And when they gain the tops and cross-trees respectively—

ALOFT TOPMEN! *Lower yard men on the sheer pole!* And when the topmen are about the futtock rigging—

ALOFT LOWER YARD MEN!

The men are to keep well in to the slings of the yards.

LAY OUT! and when the men are all in their places, FURL AWAY!

The leeches are rapidly passed in, the sail skinned up snugly and tightly, and the gaskets passed square. When ready, the boatswain's mate in attendance, will pipe down the clew-jiggers and buntlines. After furling, the men remain on the yards until the order—

Lay in! And when the yards are clear—

DOWN BOOMS! LAY DOWN FROM ALOFT! Or, the preparatory order may be given—

Stand by the booms!

Lay in! &c., &c.

To Furl from a Bowline, call—*All hands furl sails!* And when the men are reported up,

ALOFT TOP-GALLANT AND ROYAL-YARD MEN!—(pause)—ALOFT TOP MEN!—(pause)—ALOFT LOWER-YARD MEN! the gear being manned as before.

Haul taut! CLEW UP! HAUL DOWN! Or, simply, *Haul taut!* SHORTEN SAIL!

LAY OUT AND FURL! *Lay in!* DOWN BOOMS! LAY DOWN FROM ALOFT! Haul taut the rigging square yards, and pipe down.

REMARKS ON FURLING.

To furl a sail well, every cloth must be *handed;* that is, gathered up in handfuls, and each handful *stowed.* When this is done, let all hands lay hold of the skin all along; shake the slack canvas into it, and then toss the sail up, bringing the skin as a covering over the upper side of it. The bunt in this way will be low and round. The outside only will be wetted in the event of rain, and will dry without even being loosed.

It is proper to cause all the men not stationed for squaring yards to quit the top at the pipe "Down from aloft," and then, when the yards are squared, to pipe the remainder down together.

The evolution is not completed while even one straggler is above the netting.

High and Low Bunts. Low, or rolling bunts, require bunt-gaskets, and are tedious to stow, and secure snugly; high or French bunts require no gaskets, but secure to the topsail-tye by a becket and stop. Being larger, and more open abaft, the slack sail is more easily stowed in them than in low bunts; neither is any time or labor lost about bunt-gaskets, a circumstance not to be overlooked, in competing with other vessels.

The look is a matter of taste; in foreign navies topsail yards are thought neatest, with first or second-reef earings hauled partly out, but neither reef-points tied, nor bunt-gaskets on. In our service the reefs are never hauled out for furling and the bunt is peaked up by the bunt-jigger. Bunt-gaskets are used in addition.

NOTE. The proper place for the furling-glut is two thirds of the depth of the first reef.

TO LOOSE SAILS—PORT ROUTINE.

Five minutes before the time for hoisting the colors have all hands called to loose sails, and as soon as the people are up,

Stand by to lay aloft the ready-men!

LAY ALOFT!

At which the four captains of the tops, two fore and two main-yard-men, lay aloft (and others who may be appointed). The booms are got ready for tricing up; clew-jiggers hooked; sheets and clew-lines well overhauled;* covers taken off the fore-and-aft sails, and the square sails, if a steamer.

* If clew-jiggers are not used, the clew-lines should be kept fast, and the buntlines alone hauled up. It is a common practice in port to shift the top-sail sheets from the clews to the lower cap.

LOOSING AND FURLING.

Three minutes before the time—

Beat the call! ALOFT SAIL LOOSERS!

Man the boom tricing-lines!

TRICE UP! LAY OUT! LOOSE! The clew-jiggers and buntlines are well manned, ready for pulling up; sheets and clew-lines *well overhauled.* The officer of the fore-castle reports, "*All ready forward, sir!*" the midshipman of the main-top reports, "All ready with the main, sir!" and the midshipman of the mizzen-top, "All ready with the mizzen, sir!" when—

Stand by! And to the drummer—

Roll off! And at the third roll—

LET FALL!

LAY IN! LAY DOWN FROM ALOFT!

At the order "LET FALL," the clew jiggers and buntlines are pulled up, and if not marked (the latter by toggles), then squared by the boatswain's mates.

At the third roll, the bell is struck, colors hoisted, and unless there are reasons to the contrary, as the sails are let fall, the quarter and stern boats should be lowered together, and hauled out to the booms with their colors set.

The booms are left up. The clew-jiggers and buntlines should be up square alike; the jibs spread out on the netting, and the spanker brails slacked up.

If the light sails are bent and in the rigging, they are loosed at the same time and let fall with the rest.

When loosing to a bowline or otherwise, if the sails are reefed, first let fall, shake out the reefs, and then haul out or pull up.

TO LOOSE SAILS TO A BOWLINE.

Call all hands to loose sails, as before.

Have the rigging hove off the pins, and led out or coiled down clear for running.

Some ships keep their top-gallant yards aloft nearly all the time, and it may happen that both top-gallant and royal yards are aloft, in which case, before "beating the call"—

Aloft sail loosers of the top-gallant sails and royals! and when they have gained the tops and cross-trees respectively,

Beat the call! and

Aloft sail loosers! &c., as before.

LOOSING AND FURLING.

Loosing sails in the morning, is done, not only for exercise, but for airing the sails, which is essential for their preservation. If they are very wet from rain or by heavy dew of the night before, hauling up the clew-jiggers and buntlines will not suffice; they must then be "loosed to a bowline," therefore, after the ready-men are aloft, give the order—

Toggle the bo'lines!

At this the men aloft toggle the top-bowlines to the buntline-toggles; and, in addition to their other preparations, the head-halliards are snatched and led along; the down-hauls coiled down ready for running; hands are by the clew-garnets ready to ease away; fore and main buntlines and leech-lines, well over-hauled before hand; clew-ropes are bent to the trysails ready to haul out; the head halliards, top-bowlines, and clew ropes, well manned; the sails are loosed as before, and when all is reported ready—

Stand by! and to the drummer,

Roll off! At third roll,

LET FALL! LAY IN! LAY DOWN FROM ALOFT!

At the order, *Let fall*, the men run away with the bowlines and head halliards; the courses are let fall so as to hang square from the yards; the clews of the topsails hang down alike, whether the sheets and clew-lines remain bent or not; the bowlines out square, the head-sails taut up, and the top-gallant sails and royals, if aloft, have their buntlines (if any) and clew-lines well overhauled.

TO SHORTEN SAIL.

If the sails are sufficiently dry, it is usual to furl at seven bells in the forenoon watch; before furling, however, it may become necessary to "shorten sail." When a fresh breeze springs up, a ship with so much canvas gets uneasy at her anchor; or, there may be indications of rain. For whatever reason, if it becomes desirable, call, *All hands shorten sail!*

And when the people are up,

LAY ALOFT TOP-GALLANT AND ROYAL YARD-MEN!

Man the clew-jiggers and buntlines, head down-hauls! spanker and trysail brails!

Tend the halliards and bowlines!

Haul taut! SHORTEN SAIL!

Furl the top-gallant sails and royals! Stow the flying jib!

Furling the light sails before the rest is a common practice, particularly when short handed. It is entirely optional, how-

LOOSING AND FURLING.

ever, and if preferred to furl altogether, the orders relating to them will be omitted. The same applies to them when in the rigging. At the order, *Shorten sail*, the bowlines and halliards are let go, the head-sails are hauled close down, the square sails are hauled up by the clew-jiggers and buntlines, and the trysails brailed up.

TO LOOSE SAILS AND CROSS TOP-GALLANT YARDS—PORT ROUTINE.

Preparation: Send the ready-men aloft to overhaul the lifts and braces; prepare the studn'-sail booms for tricing up, bend the top-bowlines to the buntline toggles, overhaul the gear of the courses, coiling it snugly on the lower yards. Get covers off all sails, stretch along halliards, bowlines, &c.

Call—*All hands loose sail and up top-gallant yards!*

Beat the call!

ALOFT SAIL LOOSERS AND TOP-GALLANT YARD-MEN!*

*Send down the yard ropes!**

The yard-ropes having been paid down, led along and manned; hands attending in the rigging,

Set taut!

SWAY OUT OF THE CHAINS!

Man the boom tricing lines!

SWAY ALOFT!—(pause)—*Trice up! Lay out and loose!*

And when ready, *Tend the lifts and braces! Stand by!*

Roll off! and at third roll—

LET FALL!*

SWAY ACROSS!*

Or, omit the last two, giving the cautionary order at the proper time—

*Stand by to let fall and sway across at the third roll!**

TO MEND SAILS.

If the sails have been badly furled, or for any other reason they require restowing, call—*All hands mend sails!*

And when up—

ALOFT SAIL LOOSERS!

Man the boom tricing lines!

TRICE UP? LAY OUT AND MEND!

* See remarks on omitting orders, under head of "Commands."

SQUARING YARDS.

The sails are not let fall, but the gaskets are cast off and the sails restowed, getting a smooth skin on it, and the gaskets passed afresh. When completed—

Lay in!

Down boom!

LAY DOWN FROM ALOFT!

After the men have been ordered down, it is not desirable that any one should linger on the yards to stuff in a reef-point, tuck away the stop of a gasket, or for any other purpose; on the contrary, all but the top-keeper should lay down promptly when piped down.

TO SQUARE YARDS.

Immediately after furling, or after any evolution, having the hands on deck, the officer of the deck may give the order—

SQUARE YARDS! or the boatswain may pipe the same. The boatswain then commences forward, and, assisted by his mates, squares the head-yards by the braces, then the after-yards. By the time he has finished, the officer of the deck should have a boat manned and ready for him to pull ahead and around the ship; after furling, the square-yard-men generally remain aloft; if they are on deck, as the boatswain leaves, or is about to leave the side, order—

Stand by, to lay aloft the square-yard-men! and when ready—

LAY ALOFT!

GET THE LIFT-JIGGERS ON!

The boatswain then pulls ahead and squares the yards by the lifts, by means of homographic signals.

When the yards are square and the rigging hauled taut, the boatswain, on his return on board, should report: "The yards are square and rigging taut." He will then be directed to pipe down, when the square-yard-men will lay down together.

If the boats are to be lowered at color hoisting, three minutes before, order—"*Boat-keepers aft to lower your boats!*"

Roll off, and at third roll, *lower away!* The falls should be neatly stopped up without special orders, and the boats hauled out to the booms, with their colors set, awning spread, or sails loosed, as may be the example of the flag-ship.

When top-gallant yards are across, the jack must be hoisted and hauled down with the colors.

REMARKS ON SQUARING YARDS.

In order to square yards well the boatswain should pull a good distance ahead of the ship, and to save his voice he may use homographic signals; for example: let the arm, extended and depressed at an angle of 45°, represent a lower yard, starboard or port, according to the side used. The arm in a horizontal position, a topsail yard; elevated 45°, a top-gallant yard; and perpendicular over the body, the royal yard. A tiller, stretcher, or boat-hook in the hand may be used to indicate the fore; cap, handkerchief, or paint-swab, the main; and the empty hand the mizzen. Then the boatswain, facing the ship and holding a handkerchief in his left hand, the arm being extended and depressed 45°, would mean "Main-yard a starboard," which the boatswain's mate on the jib-boom must repeat, and the starboard main lift be hauled upon; the remainder, such as pulling heavily or lightly, slacking the opposite lift, belaying, &c., may be done with the "call."

Midshipmen acting as boatswains, and boatswains' mates, on board the practice-ships, should avail themselves of every opportunity to practise with their calls, so as to use them instead of the voice, whenever it be possible.

The external appearance of a ship has always been considered of the first importance, and it is often taken as an index of her general condition. The boatswain should therefore be very rigid in his scrutiny, and the executive officer be frequent in his outside inspections. Before attempting to square yards, the boatswain should see that the masts are properly lined, particularly the lofty spars, which are so apt to get out. The yards should be *down in their places*, and amidships; otherwise it will be impossible to get them square. There should be marks for the light yards; and, on the lower caps, a small block of wood secured for the topsail yard to rest upon; or, a midship lift may be used. When squaring the topsail yards by the lifts, the laniards should be unrove to two or three turns, and the jiggers hooked and hauled taut, that when topping up on one, the other may be eased by the jigger, to avoid jerking. When the "belay" is piped, clap on a heavy racking of spun-yarn. When squaring the light yards by the lifts, hands should *tend the braces*. Be very particular not to let the yards get *bowed*. The studding-sail booms should be rigged out alike, and the heels square; the clew-lines chock up, and sheets taut. The gaffs should be peaked up alike and parallel to the stays.

The staying of the head-booms is very much a matter of taste, though they should never have an upward curve. All rigging should be hauled well taut, and the ropes in the tops neatly flem-

ished down. There are numerous other points which a careful officer will look to, such as having the wind-sails squared, boats even with the rail, cat-block triced back, hammocks levelled, not a single rope's end hanging down or a slack rope to be seen, &c., &c., &c.

TO CROSS TOP-GALLANT AND ROYAL YARDS.

The top-gallant and royal lifts and braces on each side are connected, being fitted together with an eye to go snugly over the yard-arms, the latter being scraped and slightly greased.

When not crossed the yards are kept in the lower rigging, the top-gallant yard on one side and the royal yard on the other; their lower ends resting in the channels, or in a becket, or stirrup, and the upper end secured to the forward shroud. They are generally kept rigged with the sails unbent, until on the eve of sailing; the sails kept in the sail-room unexposed to the weather.

The fore and mizzen top-gallant yards are kept on the port side, the main on the starboard.

The topmen are exercised in vessels-of-war, morning and evening, in crossing and sending down these light yards, as the colors are hoisted or hauled down; which, being one of those exercises witnessed by all the vessels around, should never be performed in an unseamanlike manner.

In preparing to *cross a top-gallant yard*, the yard-rope with the lizard on, is rove through the sheave hole in the mast, the forward end leading down forward of the yards and top, passed through the grommet on the yard-arm, and bent or hooked to the slings of the yard. The lizard which traverses on the yard-rope, is rove through the thimble of the quarter-strap, and the end secured at the slings. The after or hauling part of the yard-rope is kept coiled down in the top, and is paid down on deck and rove through a snatch block hooked to the deck, abaft the mast, when prepared for use.

The lift and brace, for the upper yard-arm, is kept at the topmast-head, and the lower one is overhauled down to the topmast rigging abreast of the topsail yard; a man being stationed to attend to each. The braces are let go and overhauled on deck, and hands are stationed by them. In swaying the yard up, as the upper end reaches the topmast cross-trees, the yard-arm is released from the grommet, and the lift and brace put on; and when the lower yard-arm is "high enough," the lower lift and brace are put on *over the snorter;* the lower lift is immediately hauled taut by a man in the top, who takes in the slack, keeping *it taut* as the yard goes up, and getting it down to the square *mark* as soon as possible.

TOP-GALLANT AND ROYAL YARDS.

Then "sway higher,"* until the centre of the yard is above the topmast cap. The man on the cross-trees casts off the lizard from the slings of the yard, and keeps it up and down ready for crossing by one turn, and catches a turn with the parrel lashing.

Have hands by the braces and lifts, man the yard-rope, and when ready, sway up on the yard-rope, and lower lift, steadying the yard by the braces. When it is across, settle it down on the cap and secure the parrel.

Round the yard-rope up into the top, coil it down snugly, and square the yard by the lifts and braces.

To send it down. Having the yard-rope bent to the slings of the yard, and confined to the quarter by the lizard, and a tripping-line bent to the snorter, on the opposite yard arm, leading down on deck; the lift on the side the yard is going down overhauled, and a little of the brace hauled in to clear the yard of the rigging; hands by the parrel, braces, and lifts; man the yard-rope, and lift on the side that the lizard is. "*Sway*," and the yard will go clear of the cap and hang by the yard-rope, then lower away, clearing the yard-arms of the lifts and braces, and bearing it clear as it goes down. Secure it in the lower rigging as before.

Stop the lifts and braces in snugly at the mast-head, and coil down the yard-rope in the tops.

When the yard is crossed at sea, the double block of a luff-purchase is attached to the yard-rope abaft the mast, the single-block hooked in the top; the fall (being the halliards) leading down on deck.

For the royal yards, the halliards are single, leading from the sheave hole in the mast down on the deck; or they may be rove through two single blocks, for greater facility in hoisting.

At sea, the light yards are sent up and down to windward and abaft the lower yards.

In exercising top-gallant and royal yards in port, checking lines for the lifts and braces may be used, by which they are hauled into the mast-head the moment they are clear of the yard-arms.

TO CROSS TOP-GALLANTS AND ROYAL YARDS—PORT ROUTINE.

At five minutes before the time for hoisting the colors—8 or 9, A. M., give the order to call—

All hands up top-gallant and royal yards.

* Instead of the men aloft singing out, "Sway higher," let them motion with the hand to the boatswain's mate in attendance, who is then to use his call.

SENDING DOWN YARDS.

The crew having rapidly and quietly gained their stations,

At 3 minutes before the time—

Beat the call! ALOFT TOP-GALLANT AND ROYAL YARD-MEN!

Send down the yard-ropes! and when ready—

Set taut! SWAY OUT OF THE CHAINS!

At this order, the upper top-gallant yard-arm is carried clear of the top rim, the royal yard clear of the cross-trees.

When the yards are steady, and the men shortened in on their holds—

SWAY ALOFT! When high enough for rigging the yard-arms, the order is given—

High enough! And when rigged—

Sway higher!

When ready for crossing—

Tend the lifts and braces!

Stand by! To drummer— *Roll off!* And at the third roll—

SWAY ACROSS!

The yards are squared by the lifts and braces—

HAUL UP THE YARD-ROPES!

When they are hauled up and neatly coiled away in the tops. Then—

Stand by to lay down together! (Not needed with a well-trained crew.)

LAY DOWN FROM ALOFT!

TO SEND DOWN TOP-GALLANT AND ROYAL YARDS—PORT ROUTINE

Five minutes before the time for hauling down the colors, order the boatswain to call—

All hands down top-gallant and royal yards! And when ready—

Beat the call!

ALOFT TOP-GALLANT AND ROYAL YARD MEN!

Having gained their several stations—

Send down the yard ropes and tripping lines!

At which they are lowered rapidly, the yard ropes snatched and led along (though not to be too strongly manned), and taken near a cavil ready to catch a turn for lowering, which should be

UNBENDING SAILS.

done by a careful hand. The tripping lines have a small tail-block at the end; this is immediately taken to an eye bolt well forward of the mast, and at the side. Both the yard rope and tripping line are snugly stopped in the slings of the yards, by a split-yarn stop, which is to be broken at the *first roll.*

Man the yard ropes and tripping lines! Tend the lifts and braces!

Stand by! To drummer—*Roll off!* And at the third roll—

SWAY!

When the lifts and braces are clear—

LOWER AWAY TOGETHER! And if checking lines are not used—

Stop in the lifts and braces! And as soon as it is observed that the men are ready—

LAY DOWN FROM ALOFT!

When the yards are crossed in the morning, the yard rope may be left stopped out to the quarter strap, and the bight overhauled down and stopped in to the slings; then at the first roll at sunset, the stop may be cut or broken.

That all the squadron may be prepared to cross yards and loose sail at *eight*, or for any other manœuvre deemed proper at the hoisting of the colors, the flag-ship sometimes makes it a rule to designate seven bells (7.30 A. M.) by making the preparatory signal at that time. The squadron then have an opportunity of regulating their time by the Admiral's, and making such preparations for eight as may be necessary.

If this be done, and another very proper rule enforced—viz., allowing no one, on any account, to be aloft between five minutes before eight and the time of making the signal—every ship will be upon an equal footing, for some ships make all the preparations, such as overhauling the gear, &c., at seven bells; and if the ready-men are permitted to remain aloft they have greatly the advantage over those who are not.

TO UNBEND SAILS.

To Unbend a Course. Haul it up, furl and pass yarn stops around it, cast off the robands, secure the buntlines around the body of the sail, cast off the leechlines and slablines, ease off the earings, and, at the same time, lower away by the buntlines and clew-garnets; untoggle the bowlines, unshackle the tacks and sheets, and cast off the gear.

UNBENDING SAILS.

A Topsail is unbent in the same manner, unshackling the sheet, unbending the clewlines, sending it down by the buntlines, and hauling it, as it is lowered, into either gangway.

Unbending a Jib. Having hauled it down, come up the stay and bend the marrying line ready for unreeving through its sheave; cast off the tack, bend the halliards as for sending out or bending, and, having unrove the downhaul, bend it so as to haul the sail in on the forecastle; set taut the halliards, hoisting the sail clear of the boom, and haul in on the downhaul, hoisting on the halliards sufficiently to keep the sail clear as it comes in, the sailors on the boom rendering the stay through its sheave.

Sails are sometimes unbent without furling and stopping up, but especially when blowing fresh, or at sea, is it better to furl a square sail for unbending, putting good stops on to keep it together. The lee-earing should be eased away first to get it to windward of the stay; then ease away to windward, and lower away on the buntlines; if in bad weather, use a tripping line bent to the lee-earing.

TO UNBEND SAIL—PORT ROUTINE.

In port, if all the sails are to be unbent together, call "All hands unbend sail." Send the men aloft, *trice up!* LAY OUT AND UNBEND! a few robands are cast off and good stops passed around the sail at short intervals. The buntlines are taken around the body of the sail and hauled taut, or pulled up a little and belayed ready for lowering. If, the gaskets are on the yard, keep a turn with the laniards; if on the head of the sail, use them to keep the sail furled, and have slip-stops on the yard to keep the sail up. Single the earings ready for easing away together. If the sails were loosed haul out on the reef-tackles, and the bunt will be more quickly furled, and be lighter. When all are reported ready, man the buntlines (if necessary to pull them up), jib-halliards and downhaul.

Stand by to ease away together!

EASE AWAY! and when the yard-arms are all clear—

LOWER AWAY OF ALL! When the square-sails come down and the jib comes in—

Lay in! down booms! &c., &c.

Strip the yards, haul taut the rigging, &c.

The mainsail and main-topsail come down the starboard side the fore and mizzen, the port.

Make up the sails and stow them below.

TO RIG OUT LOWER BOOMS.

The spanker and trysails are unbent at the same time.

For unbending in bad weather, see Chapter XXXII., on shift-sails, spars, &c.

Upon all occasions of calling "all hands," the officer of the deck should not fail to pipe down as soon as the "hands," can be dispensed with. This is essential.

To unbend sails and send down top-gallant and royal yards.—Sails loosed.

It looks well to perform this evolution furling from a bowline, in doing which it is recommended to haul out the reef-tackles.

When the topsails and courses are furled, stop them up with their gaskets (supposing the latter to be on the head of the sail), and let them hang in slip-stops, as in the preceding. Cast off leech-lines, reef-tackles, &c. Unshackle topsail sheets and clew-lines, single the head-earings, and secure the buntlines around the body of the sail, set them well taut, and belay for lowering, etc., as before.

Get the upper yards ready for coming down; stretch along and man the yard rope. When all is ready, SWAY! and ease away all the earings at the same time. As soon as the sails are clear for lowering, LOWER AWAY OF ALL!

Whatever evolution may be performing, the same uniformity and alacrity, commonly called "man-of-war style," should be observed.

Going up and down the rigging men should always go on the run, lay out together, &c., and this should be observed, not only in evolutions requiring all hands, but also when carrying out whips, top-keepers going aloft, &c.

To rig out the lower booms (port routine):

Having the booms rigged for port and ready, order, *Man the boom topping-lifts! Forward guys!* These ropes are manned, both sides equally, if by the watch, first part starboard side, second part the port, and have a hand to tend the after-guy.

Haul taut! TOP UP!

Walk away with the topping lifts until the blocks are down to the mark. When, RIG OUT! ease away the after-guys and square the booms.

To get them alongside—*Man the after-guys! Tend the topping-lift and forward guy! Haul taut!* RIG IN!

To spread awnings fore and aft, requires both watches. Slack down and loose all the awnings together, haul out the fore-and-aft tackles again, reeve and man the earings. When ready,

AWNINGS.

Haul out! and when out, *Lay out!—Bring to!* The men all lay out together, and haul out the side-stops, expending the ends. When finished, *Lay in!*

To dowse Awnings: *Lay out! Cast off side-stops!* When ready, *Pipe down!* The earings are all eased away together, the men lay in, roll up the awnings neatly, hook fore-and-aft tackles, and *Haul out!* together.

Hammock girt-lines and harbor clothes-lines are prepared beforehand and triced up at the "third roll" at sunset. All boats should be hoisted at sunset ("third roll"), for which there may be regular stations, as: After-guard and main-top men to starboard quarter boat. Fore and mizzen topmen to the port, &c., &c.

NOTE ON UNBENDING A TOPSAIL. That the topsails may go down clear bend the buntline of the side the sail goes down to the *opposite* head-earing, and at the moment preceding that of sending down, run it up to the mast head catch a turn and lower away. This insures the sail going down clear of the lower stay.

CHAPTER XXI.

GETTING UNDER WAY.

GENERAL REMARKS ON HANDLING SHIP.

In the government of the peopled deck there is scope for administrative talent of the highest order. To be prompt with the right command, judicious in the selections of sufficient means (and no more), in the control of reserves, in the anticipation of the next move, and contriving that the present command have some reference to the future, in the adaptation of resources to various circumstances—all this cannot be learned in any other school than one "under canvas," or by any other pupil than a cordial lover of his profession.

The military art may, in a great measure, be reduced to rules. It is almost a certainty that an order will produce certain results. The commander moves his pieces with nearly the precision of a chess-player. At the note of a bugle, columns form the line or consolidate in masses; a battle is declined, or an inevitable disaster is converted, by successful generalship, into an honorable retreat.

But the seaman is dependent on two uncompromising agents, and however he may accommodate his circumstances to their movements, over them he has no positive control.

Tides, seas, and wind, will rise and fall, and wait for no man. The seaman must take them as they come, and be ready with his resources; and even after his best exertions, his gain or loss is in their power. A shift of wind threw three of thirteen ships out of the brunt of the battle of the Nile. The "Culloden," commanded by an officer whom Nelson had named the "Nonpareil," grounded on a sunken rock. Fogs and calms obscured the signals and retarded the movements of Howe. A gale scattered the hard-won trophies of Trafalgar, and prevented the entire destruction of the enemy; and it was in the full conviction of the impossibility of adhering rigidly to fixed rules, that the genius of Nelson threw himself so trustfully on the bravery of his men and the undirected ability of his captains.

These observations are not made with the intention of drawing an invidious comparison, but to magnify our own profession in the estimation of our young sea officers; so that they may take a large estimate of the qualifications for command.

GETTING UNDER WAY.

It is true that steam may place his force more at the disposal of the naval commander-in-chief than formerly, yet bearings may get hot, shells may drop into the best masked engine-room, and machinery of the most perfect description may fail at the hour of need; and without meaning to maintain the infallibility of sailoring, it is not very certain that coal whips will altogether outlive tacks and sheets.

It has been observed by an officer, whose high scientific attainments place him beyond the suspicion of disparaging theoretic knowledge, that however informed, taught, and improved by book learning, naval officers may be, they are aware that seamanship is the most essential part of their education; that it can only be learned afloat and by practice; that it needs certain qualities of head, eye, character, and constitution, *not easily or quickly acquired;* but, therefore, proportionately valuable. Neither the differential calculus nor dynamical study will enable an officer to manage his ship in a gale of wind or an action. He must neither overlook nor undervalue plain duties, while studying mathematics and philosophy.*

REMARKS ON CASTING.

When there is plenty of sea-room, and the wind is fair, it is best to cast under the head-sails, and to make sail when before the wind.

In casting with the square sails set, ships invariably gather sternway the moment the anchor breaks ground. On this account, and under these circumstances, it is considered a good general rule (in the case of a foul wind) to cast with the head towards the nearest of the neighboring dangers, to make a stern board while the anchor is being catted, then to fill and make sail enough to insure going about in stays when requisite.

When there is not room to admit of going much astern, set the main-sail before starting the anchor, if possible, or as soon after as it will take, and have a purchase all ready to clap on the cable the moment that the anchor promises to give a heavy heave; otherwise the ship may go tripping it astern into shoaler water, and certainly will be unmanageable until it is at the bows.

As a general rule, and one not to be neglected, when weighing one anchor have the other ready for letting go, and as soon as an anchor is weighed get it ready for letting go at once.

* Boyd's Naval Cadet's Manual.

PLATE 79

GETTING UNDER WAY.

When you have room, and are pitching, it will be best to get the anchor up before making sail. By so doing you will ease the chain, nippers, capstan, messenger, &c.

When about to get under way (the ship being tide rode and the wind aft), the comparative strength of wind and tide must be well considered before coming to the decision to make sail and weigh, or to weigh first and to make sail afterwards. For it looks ill to see a ship under canvas forging ahead over her anchor, tearing the copper off her bottom, breaking the nippers, and sheering unmanageably about before breaking ground; and it is equally bad management when the anchor is hove up and the ship is drifted by the tide without steerage way.

If the wind were light, it would be necessary to make nearly all sail before breaking ground; or if moderate, merely to loose them. If it were blowing strong, the ship might stem the tide without any sail; but in this latter case it would be well to have a head-sail set, so as to prevent the possibility of breaking the sheer while stowing the anchor.

TO GET UNDER WAY AND STAND OUT ON A WIND. CASE 1, PLATE 79.

Having the vessel in readiness for sea, and unmoored, prepare to get under way as under ordinary circumstances, with the wind fair for standing out of the harbor.

Pass and lash the messenger; get up the nippers and capstan bars; rig the fish, and reeve the cat and fish purchases; send the *ready-men* aloft to get the sails ready for loosing; ship the gratings; ship and swifter the bars; call, *All hands up anchor!* Bring to on the cable, and unbitt; man the bars, HEAVE AROUND! and heave in the cable to a *short stay*.

As soon as "brought to," the first lieutenant orders the navigator to inform him when the chain is in to a certain scope, say 15 fathoms chain in 5 fathoms water, though it depends entirely upon the strength of the wind and sea.* When in to the required scope, the navigator orders, AVAST HEAVING! and reports to the first lieutenant, who then directs the men to be sent up (supposing it a frigate) to make sail.

The cable being in to a short stay, *Pawl the capstan!* stopper the cable well, and unship the bars.

Stations for loosing sail! Lay aloft sail-loosers! and when the men are aloft and ready, LAY OUT AND LOOSE! *Man the top-sail*

* The old rule for a short stay was, that the cable should be on a line with the fore topmast stay.

GETTING UNDER WAY.

sheets and halliards! In the meantime the forecastle men are loosing the head-sails, and the after-guard the spanker; when ready, *Stand by!* LET FALL! SHEET HOME! LAY IN! LAY DOWN FROM ALOFT! The men all lay down on deck, except a few hands in the tops to light up and overhaul the rigging; at the same time, *case* away the topsail clewlines, and haul close home the topsail sheets.* As soon as the men are clear of the yards, *Tend the braces! Haul taut!* HOIST AWAY THE TOPSAILS! giving also the cautionary order, *Light up the rigging aloft!* Hoist the topsails to a taut leech, and *Belay the topsail halliards!* or *High enough the fore! Well the mizzen! Belay the main!* &c., &c. Sheet home and hoist the top-gallant sails, and then the royals, if the wind is light. Brace up the after-yards for the tack on which you wish to cast, and the head-yards abox to pay her off. Top up the spanker-boom, and bear it over on the side you wish to cast.

The following orders are commonly used; sail being made:

Man the port head braces! Starboard main, port cross-jack braces!—or, the reverse, as you wish to cast (starboard watch generally to after, port watch to head braces).

Let go and overhaul the lee lifts! Clear away all the bowlines! Tend the lee braces!

Haul taut!

BRACE UP!

BRACE ABOX!

Sometimes the cross-jack braces are crossed when the command will be—

Port (or starboard) *head, Starboard* (or port) *after braces!* &c., &c.

It will be observed that the booms are not triced up when loosing to get under way; this is optional, however.

The sails being set, *Man the bars!* ship and swifter them; *Heave around!* at the same time giving her a sheer with the helm. The officer of the forecastle reports when the cable is "*up and down*," and also, when the *anchor is* "*aweigh!*" at the former report, *Man the jib and flying-jib-halliards!* The fore-topsail pays her head off, and as soon as the head-sails will take the right way, *Let go the downhauls, hoist away!* Put the helm a-lee for stern-board, at the same time, heave the anchor up to the bows; and as soon as it is high enough, *Avast heaving! Pawl*

* With a full crew the top-sail should be sheeted home and hoisted at the same time.

GETTING UNDER WAY.

the capstan! stopper the cable; cat and fish the anchor. When she has fallen off sufficiently, *Right the helm!* Brace around the head yards, and set the spanker. Trim the yards and stand out to sea, making sail as required.

As soon as the anchor is catted, the navigator causes the cable to be bitted and cleared for running, and having nothing more to do in that station, repairs to his station at the wheel, to assist in conning the ship, or acting as pilot. Having passed the bar-buoy, and seeing that all the sails are properly set, the anchors and boats secured, and no further necessity for all hands to be on deck, the first lieutenant reports the fact to the captain, who directs him to "pipe down." On the boatswain piping down, the officers leave their stations and the lieutenant of the watch takes the trumpet, receiving the course from the pilot or navigator.

In some cases, though rarely, the captain gets the ship under way. When he does not, the first lieutenant does it, though he is still responsible for the manner in which it is done.

In getting under way in a spacious harbor, where you have sufficient room, if circumstances will admit of it, it is advisable, particularly if blowing fresh, to keep the fore-topsail to the mast until the anchor is catted and fished; to do which set the spanker as soon as, or before, she breaks ground, and keep the head-sails down; or having hoisted the jib, brail it up until the anchor is fished, or flow the jib-sheet in the absence of brails.

Should it blow sufficiently fresh, and present appearances of heavy weather outside, it is advisable to reef the topsails while setting them.

When getting under way to stand off *on a wind*, the spanker may be set, and very often is, when sail is made; guying the boom on the lee quarter, or the side to which you cast, as this assists in a measure, by sending the stern to windward, and catches the vessel should she be inclined to fall off too much.

Making sail to royals should be done rapidly; the sheets got close home, or "home alike," and the sails hoisted up taut.

There are three ways of making sail: first order the top-gallant and royal-yard men to "keep fast," and not let their sails fall till ordered; then, as soon as the topsail yards are mast-headed, *Let fall, sheet home and hoist away the top-gallant sails!* and as soon as they are up, *Let fall sheet home, and hoist the royals!* Second, let everything fall together; sheet home and hoist together; then, when the topsail yards are up, the top-gallant sheets will be home. The same with the royal sheets, when the top-gallant yards are up. But this requires care, lest, in the excitement of

quick working, the top-gallant sheets or topsail yard should be carried away. The former should be tended, and the halliards marked. Third, as most commonly practised, let everything fall together, sheet home and hoist the topsails, and then the top-gallant-sails and royals in quick succession.

Before breaking ground, be sure the ship has the right sheer, else the jibs may take the wrong way and the ship fail to cast as desired.

If you cannot break ground and are apprehensive that the anchor has hooked under a rock or permanent moorings, clew up and furl, and let go the other anchor; then bring the buoy-rope in through the sheet hawse pipe, and endeavor to weigh it by that means, or get out the launch and let her weigh it. Should the buoy-rope prove unequal to the strain, send a hawser down over the buoy-rope by a running bowline, catch it over the upper fluke, and weigh it by that.

A steamer can generally break her anchor out by stoppering well the cable and going ahead slowly.

TO GET UNDER WAY FROM FIXED MOORINGS.

Proceed as in the above, bracing the yards as you wish to cast, then slip the moorings and trim the yards to the course, or use a spring from the moorings if circumstances require, taking both ends of the spring inboard that you may let go one end, unreeve and haul it on board.

TO GET UNDER WAY AND STAND OUT BEFORE THE WIND, CASE 2.

In some cases, particularly with the wind directly out of the harbor, vessels are got under way under the jib and spanker alone, thus: having those sails loosed and ready for setting, *Man the bars!* and heave the anchor right up to the bows, giving her a sheer with the helm whichever way you wish to cast. It is always advisable, if possible, to cast from the anchor; that is, if heaving up the port anchor to cast to starboard; because it is easier thus hove up to the bows after it is atrip, and the cat more readily hooked. As soon as the anchor is aweigh, hoist the jib; and as she pays off, haul out the spanker. Keep her under this sail, until the anchor is catted and fished; then hard up, brail up the spanker, make sail and stand out.

LYING IN AN OPEN ROADSTEAD BY THE STARBOARD ANCHOR, HEAD TO THE WIND, BLOWING DIRECTLY OUT—TO GET UNDER WAY IN THE SHORTEST MANNER POSSIBLE. CASE 3.

Having everything in readiness, bring to on the cable, *Man the bars! Heave taut!* off stoppers, unbit the cable, and *Heave*

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around! When the cable is up and down, *Clear away the jib!* put the helm to port, and continue heaving until the anchor is up to the bows; *Pawl the capstan!* Cat and fish the anchor, surging the messenger and sticking out the cable, as the men walk away with the cat. As soon as the anchor is aweigh, hoist the jib. Range the cable, and have the anchor ready for letting go.

She is now paying off under the jib. As soon as she gathers headway, *Shift the helm! Stations for loosing sail!* LAY ALOFT SAIL LOOSERS! LAY OUT AND LOOSE! *Man the topsail sheets and halliards!* When before the wind, and ready for letting fall, *Right the helm!* LET FALL, SHEET HOME! and HOIST AWAY THE TOPSAILS! *Man the top-gallant and royal sheets, and halliards!* SHEET HOME AND HOIST AWAY! Set the foresail; sheet home the royals as the top-gallant yards are mast-headed. *Haul taut the lifts and trusses!* keeping the lower yards square by the lifts; hook the burtons on the topsail yards, and haul them well taut; haul taut the top-gallant lifts, and *Stand by to set all the studding-sails!*

RIDING HEAD TO WIND, WITH A ROCK OR SHOAL ASTERN, AND CLOSE ABOARD—TO GET UNDER WAY AND MAKE SAIL, BY THE WIND, ON THE STARBOARD TACK. CASE 4.

The object now is to get the vessel under way without losing anything, either in drift after the anchor is aweigh, or in falling off after casting.

Having hove in to a safe scope, run out a hawser ahead, with a kedge, from the starboard bow; and having let it go, haul the hawser well taut; mast-head the topsail and top-gallant yards, having the sails loosed, and only confined to the yards by the quarter gaskets; brace the yards sharp up by the port braces, fore and aft; loose the courses, jib, and spanker, and have them ready for setting; the starboard jib-sheet aft, and the fore and main tacks and sheets stretched along the deck.

Man the bars, and heave around briskly, until the anchor is up; taking in at the same time, the slack of the hawser; cat and fish the anchor; range the cable; and have the anchor ready for letting go as soon as possible.

Man the hawser and warp the vessel ahead, sheering her with the starboard helm. Have the topsail sheets well manned, and as soon as the kedge is short apeak, or comes home, sheet home the topsails, run up the jib, haul out the spanker, with the boom on the port quarter; and as soon as the jib takes, with the wind on the starboard bow, run the kedge up to the bows.

As she falls off, and the moment the topsails take, draw the jib,

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set the courses, and top-gallant sails, and right the helm. Should the kedge come home before it is apeak, make sail immediately, hauling in the hawser at the same time.

If she is falling off rapidly when the topsails take, set the spanker and mainsail alone, easing off the jib-sheet; and as she comes to, board the fore tack, haul aft the jib-sheet, and meet her with the helm.

If, when the kedge is aweigh, she should fall off to starboard, and bring the wind on the port bow, let go the anchor and bring her up. By this process you have warped considerably ahead of the anchorage, and by counter bracing the head yards you may get under way, as under ordinary circumstances, or you may run out the kedge again, and make a second trial.

If, while warping ahead, the kedge comes home, or the hawser parts, proceed at once to make sail or let go the anchor.

ANCHORED ON A LEE SHORE, TO GET UNDERWAY AND STAND OFF. CASE 5.

When close to a lee shore with too much wind or sea to get the anchor easily, or when you cannot afford to go astern, the ship must be cast with a spring, and the anchor abandoned. Thus, supposing that the ship is riding by the starboard anchor, and that it is determined to cast to port, brace the yards up on the starboard tack, have the sails ready for setting, with the number of reefs in that may be necessary; hoist the topsail yards sufficiently high for setting the topsails, and cast as many gaskets off as can be spared. Pass one end of a buoy-rope in through the riding cable hawse hole, and make it fast to that cable close before the bitts, stopping it along to the cable at intervals to prevent fouling, put a buoy on the outer end, and hang it outside all to the bumpkin. If riding with nearly a whole cable out, prepare to disconnect its end from the slip in the locker, drive the shackle-pins out and see the cable clear for running. If riding with only part of a cable out, you may be able to disconnect further up, and thereby save so much chain; but it would not be prudent to unshackle until the ship is sure of going the right way, for a flaw of wind might bring her to, after having gone off to port a certain number of points, and it would then be necessary to hold on for another trial. In such case, unusual strain would be brought on the cable fastenings, and if they carried away or rendered, and the cable were unshackled, you would be adrift; but were it still connected, it would bring you up.

Pass the end of a hawser from the starboard quarter outside all, and make it fast for a spring to the riding cable at the hawse

GETTING UNDER WAY.

hole; haul it taut, make fast and have an axe ready for cutting it. Haul the head sheets aft on the starboard side. Be all ready to loose and make sail and veer cable. Put the helm a starboard, and when the ship's head is sheering to port, hoist the head sails, veer away cable, and put the helm amidships; when the head sails have taken well and the ship is evidently swinging from her quarter by the spring, disconnect the cable, warning the people to stand clear of the end, and let go the buoy. Set the courses and then the topsails, if not able to set all at once; and when the wind is *well on the starboard beam* (and not sooner, otherwise the ship will fly into the wind before she has steerage way enough to keep her out of it), cut the spring, trim the head sails, and when you have good way on, bring her gradually to the wind.

Getting under way in a Tideway. In the foregoing examples, we have had nothing to consider, in getting under way, but the effect of the sails and helm on the vessel; but in a tideway, we have also the force of the current to guard against, or profit by, during the operation.

Lying at anchor in a tideway, a vessel will ride to the wind or tide whichever is the stronger; and whatever influence the rudder has upon her movements, caused by the resistance which either side of it presents to the force of the water against it (which will act upon the stern of the vessel until checked by the cable, in proportion to the velocity of the current), that effect will evidently be the same, whether she is forced through the water by the sails or by other means; or being stationery, the water rushes past her.

RIDING HEAD TO WIND AND TIDE, TO GET UNDER WAY, CASTING TO PORT, AND STAND OUT ON THE STARBOARD TACK. CASE 6, PLATE 79.

Heave short, keeping the helm a-starboard, which (the tide acting on the port side of the rudder), will bring the wind a little on the starboard bow. Set the topsails; brace the after yards up by the port, and the head yards by the starboard braces; have the jib and spanker ready for setting; man the bars and heave the anchor up to the bows. The moment the anchor is aweigh, hoist the jib; and the moment she has paid off sufficiently (which she will) to port, brace around the head yards. If she gathers sternway before the head yards fill, shift the helm; and then proceed as in former evolutions.

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TO BACK ASTERN. CASE 7, PLATE 79.

If you have not room to cast, either to port or starboard, from your anchorage—suppose a vessel on each quarter—weigh the anchor, and drift down between the vessels before you cast, thus:

Heave short; set the topsails and spanker; brace all the yards about halfway up by the port braces; then heave in on the cable, and as soon as the anchor is aweigh, put the helm to port; the tide acting against the starboard side of the rudder, casts the stern to port; the sails being aback, she will soon gather sternboard, when the effect of the tide upon the rudder will be lost; but the resistance by sternboard on the port side of the rudder, and the effect of the spanker will counteract the tendency of the fore topsail to pay her off. In this manner let her drift down with the tide, between the two vessels. Should she pay off too much you may bear the spanker-boom well over to windward, and brace the mizzen topsail sharp up. Should she, in sternboard, be in danger of fouling the one vessel, she will increase the distance from the other, when you may brail up the spanker, shiver the after yards, hoist the jib, and let her go around before the wind, righting the helm as she gathers headway.

In like manner a vessel may be backed astern where there is no tide.

Second Method. Heave short; set the topsails, reefed if necessary, and keep the yards square; the helm amidships. Heave in again and when she breaks ground and starts astern, pawl the capstan and stopper the cable. You may thus *dub down*, and when clear of danger heave up briskly, wear and make sail as requisite.

WIND-RODE, WITH A WEATHER TIDE, TO WEIGH ANCHOR, CAST TO STARBOARD, AND GET BEFORE THE WIND IN THE SHORTEST MANNER POSSIBLE. CASE 8. PLATE 79.

Heave short; set the topsails and loose the jib; brace the head yards sharp up by the port braces, and leave the after yards square; man the bars and heave around; the moment the anchor is aweigh put the helm to starboard; as soon as the jib will take, hoist it, heaving the anchor up at the same time; as soon as the after yards take, brace full the head yards; and, as she gathers headway, shift the helm; when before the wind, right the helm, cat and fish the anchor, and make sail on your course

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At the moment the anchor is aweigh, the wind being ahead and all the sails aback, she will immediately gather sternboard; while the fore-topsail braced sharp aback, together with the jib, and the surface presented by the starboard side of the rudder to the tide, increased in resistance by sternboard, force her stern to port, and consequently her head to starboard; when fore-topsail lifts, fill away, right the helm &c., &c.

By the above arrangement of sail, the ship will get a rank sternboard, particularly if blowing fresh, and cut a broad sheer before gathering headway. This may be avoided as follows: brace the after yards about halfway up by the starboard braces, taking care to have the port after braces manned, so that they may be squared in again as she pays off; when, proceed as before. It is necessary to the perfect success of this evolution that the main and mizzen topsail *should be kept shivering* until the yards are square.

The latter method is only necessary when getting under way from a close berth. If blowing very fresh and no room to spare, the yards may be mast-headed and the *fore-topsail alone* sheeted home; which, with the jibs, will pay her off with little sternboard; when before the wind, make sail.

TIDE RODE WITH THE WIND TWO POINTS ON THE STARBOARD BOW—TO GET UNDER WAY, CASTING TO STARBOARD. CASE 9.

Heave short, keeping the helm to port, which, from the effect of the tide upon the starboard side of the rudder, will bring her head to wind. Set the topsails, bracing up the after yards by the starboard and the head yards by the port braces; set the spanker and bear the boom well over on the starboard quarter; have the jib loosed and ready for setting, with the port sheet aft. In this position, the vessel will not remain steady, but will come up and fall off; man the bars, and heave up-and-down; and, as she comes head to wind, weigh the anchor and hoist the jib, still keeping the helm to port; the head sails, and the effect of the tide upon the rudder before she gathers sternboard, will pay her head off to starboard. The moment she gathers sternboard, shift the helm; as she falls off, having the wind on the port bow, draw the jib, brail up the spanker, if necessary, and proceed as before directed in filling away and making sail.

Should she not pay off to starboard the moment the anchor is aweigh, owing to her not being head to wind; or should she, by the force of the tide on the port quarter, and wind on the after sails, be kept from falling off sufficiently to fill the head yards,

it will be necessary to veer cable and bring her up, when the evolution may be performed with a spring from the port quarter.

RIDING TO AN EBB TIDE, WITH THE WIND ON THE STARBOARD QUARTER—TO GET UNDER WAY AND MAKE SAIL ON THE PORT TACK, NOT HAVING ROOM TO MAKE THE FIRST STRETCH ON THE STARBOARD TACK. CASE 10. PLATE 79.

Heave in to a safe scope, send aloft the sail-loosers, loose the courses, topsails, and topgallant-sails, keeping the sails confined to the yards by stops and checking lines, and keeping the bunt up by a stop sufficient to hold it; have all the rigging well overhauled aloft for running; mast head the topsail and topgallant yards, and brace them up by the starboard braces fore and aft; have the sheets and tacks led along the decks; top up the spanker-boom by the port topping-lift, and bear it over on the starboard quarter; spanker and jib loosed and ready for setting, outhaul and halliards led along the decks. Keep a few top-men aloft to attend the checking lines, and have a hand in the bunt of each sail to cut the stops; man the bars, heave around briskly, and bring the anchor up to the bows; the moment the anchor is aweigh, put the helm hard a-starboard, and she will fall off rapidly to port, by the force of the tide on the port side of the rudder; as soon as the spanker will take, haul it out, which will bring her rapidly to the wind; and as she comes to, hoist the jib and right the helm; you may keep her under this sail until the anchor is catted and fished, meeting her with the helm, and keeping the wind abeam. Man the topsail and topgallant sheets, fore and main tacks and sheets; and with the wind abeam, *Haul taut! Break stops! Sheet home! Haul aboard!* Meet her with the helm as she comes to; bring her by the wind, trim the yards, haul the bowlines, and stand on to the opposite shore.

The vessel may be got under way differently; setting the topsails when the anchor is a short stay, leaving the head yards square, and bracing the after yards up by the starboard braces. The moment the anchor is aweigh, put the helm hard a-starboard. The fore topsail being full will give her headway, which may be increased by letting fall the foresail, and hauling it aboard; and the starboard helm will pay her head around to port, hauling out the spanker as it will take; which, with the after yards, will bring her to the wind, bracing up the head yards as she comes to, and meeting her with the helm. This is preferable to the foregoing method, being more certain of success.

Mast-heading the topsail and topgallant yards, and setting all the square sails together, was not necessary to the performance

of the 10th case, and was only mentioned as a method of making sail from single anchor, which an officer may adopt at his pleasure, when he feels confidence in a smart working, active crew, and in every man knowing well his station. But though unnecessary in most cases, it certainly would be advisable in cases where it is important to expose as little surface as possible to the wind until the anchor is atrip, and to have the ship under sail as soon after as possible, to prevent her losing any ground.

RIDING TO A WINDWARD TIDE, WIND RIGHT AFT—TO GET UNDER WAY AND STAND OUT BEFORE THE WIND. CASE 11.

Make every preparation for weighing, heave in, loose the jib, heave up the anchor, run up the jib; cat and fish the anchor and make all sail.

If in a crowded harbor, narrow channel, or where it would be necessary to have the ship under immediate command, proceed as follows: Suppose the ship to be riding by the port cable, heave short, loose and make sail, sheer her with the port helm and bring the wind on the starboard quarter; brace the yards up by the starboard braces and keep them shivering by the helm. Heave up, fill the after and square the head yards; haul aft the starboard jib sheet; cat and fish the anchor; up helm; fill the head and shiver the after yards, getting the ship before the wind, when make sail.

RIDING TO A WINDWARD TIDE, WIND AFT—TO GET UNDER WAY AND STAND OUT ON A WIND. CASE 12.

Make the usual preparations and commence heaving in; loose the jib and spanker; (riding by the port cable as before and wishing to cast on the starboard tack) top up and bear the spanker boom on the port quarter and put the helm aport; heave up and haul out the spanker as soon as it will take. When the wind gets abeam, run up the jib and meet her with the helm; cat and fish the anchor; loose, sheet home and hoist the topsails, brace up, bring by, and make sail.

EBB TIDE—WIND ATHWART. CASE 13. PLATE 79.

Heave short, loose sails, and set the topsails; fill the fore and mizzen and leave the main square. Then heave up; cat and fish the anchor, keeping the ship hove to, and either tack or

wear. Tacking or wearing will, however, depend on circumstances, and the amount of room to windward or to leeward.

If to tack—hoist the jib, fill away the main-topsail, haul out the spanker, and set top-gallant-sails, &c.

If to wear—hoist the jib, up helm, shiver the after sails, &c.

If she does not lie steady with the main yard square, brace it sharp aback.

WEIGHING FROM A LEE SHORE, SHIP RIDING TO THE COAST CURRENT. CASE 14. PLATE 79.

A vessel has rode out a gale on a lee shore; it is desirable to weigh and stand off; but a strong current sets along the land, and the wind blows in on the off-shore bow, as indicated by the arrows in the cut. Under these circumstances there may be two methods of getting under way.

Case 14 *a* represents the position of the ship riding by the starboard cable. Make the accustomed preparations, and heave in to a short scope without tripping. Bend a spring from the port quarter to the cable, and make sail to topsails, mainsail and spanker—bracing the after yards sharp up by the starboard braces, and the head yards abox, or rather pointed to the wind. Put the helm hard a-port; stream the buoy; slip the cable, and heave in smartly on the spring, which will bring the chain on the other bow, and cast the ship to starboard. When it will take, hoist the jib, right the helm, slip the spring, and trim the head yards, as necessary.

Case 14 *b*, in which the position of the ship is again illustrated. Here, in lieu of slipping and using the spring, the anchor is hove up, and the ship backed off, by putting the helm to starboard, instead of port, as in the previous case, while the head yards are braced sharp abox, and the after ones kept nearly square. In this case, the mainsail is not used, and the foresail set to help the ship's head pay off to port. When sternway commences, the helm is shifted to port, the after yards trimmed sharp by the starboard braces, spanker and mainsail set, when they will take, &c., &c.

RIDING TO LEE TIDE—DANGER ASTERN, AND ON EACH BEAM. CASE 15. PLATE 79.

Heave short without tripping, loose sails, and set the *fore*-topsail, and fore-top-gallant sail; lead along the halliards of all

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the head sails, as also the fore-tack and sheet, and brace the head yards sharp up by the port braces.

Mast-head the after yards, keeping them square, and stopping the sails up with rope yarns. Put the helm hard *a-port*, heave up briskly, trip the anchor, let fall the foresail, hoist the jib, with the sheets to windward, and wear short round on the ship's heel, shifting the helm when necessary. When before the wind, check the porthead-braces, make after-sail, and stand out with the wind on the quarter.

NOTE. Have an anchor ready to let go in case the ship should cast the wrong way; and observe to give her a rank sheer with the port helm, *before* the anchor breaks ground, hoisting the head sails as soon as the vessel's head passes the direction of the wind.

WIND AND TIDE CONTRARY—SHIP ATHWART THE STREAM. CASE 16.

If to get *before* the wind, square the after and brace abox the head yards. Heave up the anchor, and when the fore-topsail shivers, square the head yards.

If to make sail *by* the wind, brace sharp up the after yards, square the head ones—heave up the anchor, and when the ship comes to, brace up forward.

STRONG WIND AND LEE TIDE—WITH A SHOAL ASTERN. CASE 17.

With regard to the manner of executing this manœuvre, there seems to be a difference of opinion among sailors and tacticians; it is, however, generally conceded, that the following method is by far the most certain and secure:

Heave in to a short scope of cable, and make sail to single-reefed topsails; lead along the tacks and sheets, jib-halliards, and spanker out-haul, and brace the yards up as sharp as possible by the *port* braces, and put the helm hard a-starboard. As soon as the anchor is aweigh, let fall the courses, set the spanker, meet the ship with the helm, and hoist the jib.

NOTE. This supposes the case of casting to *port*. If to starboard, reverse the yards, and put the helm the contrary way.

TO GET UNDER WAY AND STAND OUT WITH A FREE WIND, PASSING BETWEEN TWO SHIPS ANCHORED CLOSE ABOARD. CASE 18.

The usual preparations having been made, the topsail yards mast-headed and sails stopped up, heave in to a short stay and

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let go the stream anchor, the hawser coming in through the after chain pipe or warping chock; heave up the bower and let the ship wind round and ride by the stream. Heave up the stream, sheet home the topsails, drop the foresail, &c., &c.

This may also be done in a narrow channel, when, by the usual method, there is risk of backing ashore; or a steamer may be thus winded and pointed fair for going out of a small harbor.

THE KEDGE AND TOGGLE.

When using a spring, the weighing of the kedge may be much facilitated by bending the hawser to the *crown of the anchor*, and securing it to the ring by means of a squilgee toggle. If the anchor had been carried out by a boat, let her hang on to the buoy, and at a signal from the ship, pull out the toggle, when the kedge may be run up to the quarter, and when the ship finds room she will heave to and pick up the boat.

NOTE. Some of the foregoing cases are almost precisely similar, but with enough difference to serve as exercise for midshipmen when in charge of the deck of the practice-ship; for it is only in handling a ship by various methods that they can learn the most preferable.

Empty beef barrels, breakers, &c., may be anchored about the ship, before getting under way, to represent shoals and vessels. It is recommended to throw some article overboard before breaking ground, should the former plan not be adopted, that it may be seen with how little sternboard the young officer can cast and fill away.

TO WEIGH IN A GALE ON A LEE SHORE. CASE 19.

On the evening of December 16th, 1812, H. M. S. "Magnificent" (74 guns), Capt. John Hayes, anchored with the best bower in 16 fathoms, between Chasseron and Isle of Rhe, in the neighborhood of the Basque Roads, at 9.40 P. M. The ship drove, when the small bower was let go, and brought her up in 10 fathoms, the Isle of Rhe reef being distant about the length of two cables. The lower yards and topmasts were immediately struck. By the lead it was soon discovered that they were anchored among rocks; and as they were without chain cables, it was quite obvious the hempen cables would soon be chafed through.

The gale continued, with squalls from the S. W., with rain and a heavy cross sea running. At daylight the ship again drove, and the spare anchor was let go, which brought her up.

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At noon the gale had increased, without any indication of a favorable change in the weather, joined to which, one of the cables having parted, Capt. Hayes resolved to make an attempt to save the ship. The courses having been previously reefed, and the topsails close reefed, the lower yards were swayed up to three fourths their usual height; the topmasts were secured close down, leaving the topsail yards to work on the caps; the largest hawser was passed through the starboard quarter port, and bent to the cable of the small bower, for the purpose of acting as a spring in casting the ship to port previously to cutting the cable.

The courses and topsails were secured on their respective yards with stops of spun-yarn; the gaskets having been removed. Her head and main yards were braced upon the starboard tack, the yards on the mizzen mast being kept square. It is quite evident that, in the event of the spring canting the ship, the head yards would require no alteration. On the other hand, if the spring broke, the yards could not be better placed for producing the sternboard, which would, in that case, be necessary to clear the reef.

The spring was now hove in to a tolerable strain, and all being ready, the cables were cut. The heavy sea on the port bow acting against the spring, caused it to snap; it was immediately cut adrift to prevent retarding the ship's way; the helm was put hard to starboard, the fore-staysails hoisted, the fore-topsail let fall and sheeted home, the foresail let fall, the tacks hauled aboard, and the sheet roused aft. All this sail was flat aback and set in less than half a minute. The ship's head paid around quickly towards the reef. When the wind was abaft the beam, the mizzen topsail was set, and the helm shifted. When the wind came right aft, the main topsail was set, and immediately after the mainsail. As soon as the wind came on the starboard quarter, the sails were trimmed, and the yards braced up on the starboard tack. Thus, the ship was saved.

This manœuvre, from the cutting of the spring until the sails were set, did not exceed two minutes. At the moment, when the ship's head was in the direction of the rocks, and then only in five fathoms water, the vessel made a desperate plunge; and, in hauling to the wind, the send of the sea did not leave by the soundings more than a single foot of water under the keel! The ship was shortly afterwards safely anchored in Basque Roads.

MAKING SAIL FROM A SPRING ON THE CABLE. CASE 20.

A merchant vessel is discovered in dangerous proximity to the shore of New Zealand, and is saved by Capt. Liardet, R. N., his own account of it being as follows:

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With much difficulty we got about forty men on board of the ship in two boats, when we found that she had dragged her anchors, the stock and one of the flukes of one anchor being broken; but the other was holding her well. It was blowing too hard to attempt to warp her off shore, and the ship was too near the rocks to make sail from; therefore, between the squalls, we agreed to try the following plan :—

With the stream cable, we made a spring from aft, on the port side, to the riding cable; a sufficient number of men were sent aloft to have the double-reefed topsails and the courses ready to let fall at a moment's warning; the topsail sheets and halliards were all well manned, and taut for a run; the spring was hauled taut and secured to the mainmast; the yards were all laid perfectly square, the cable was then veered gently (during one of the greatest lulls), until the wind was right on the port beam; the riding cable was then instantly well stoppered and ready for slipping with the cable of the damaged anchor, and at the same instant for cutting the stream cable; at this moment the topsails were sheeted home, and hoisted at the same time, and from the wind being right abeam, and the yards square, of course, little or no increased strain was brought on the spring or bower cable; when the topsails were up, braces, tacks, and sheets, spanker out-haul, and jib-halliards all well manned, the preparative word given to insure everything being taut, the next minute the yards were braced sharp up, and topsails, courses, jib, and spanker, all well set; by this means, we insured the ship getting way on previous to slipping the cables, and cutting the spring when the ship had sheered her cables taut, and brought her head within about seven points of the wind; consequently, she had felt and sprung to her canvas; the bower cables were then slipped, and the stream cable cut at the same instant; in less than ten minutes she was tacked, and in about two hours worked completely out of danger. In this manner was a most beautiful merchant ship of about six hundred tons, saved.

MAKING SAIL FROM A SPRING LAID OUT BY ANOTHER VESSEL.
CASE 21.

On one occasion, in 1831, in order to save a French merchant brig from being wrecked, Capt. Harding ventured to anchor the *Jaseur* in the narrow and dangerous pass of Tamatave (Madagascar), in very squally and unsettled weather. We dropped anchor in the brig's hawse about a cable and a half to windward, and immediately veered about seventy or eighty fathoms of cable; at the same time, without the least delay, we ran the end of the stream cable out to her, and a lieutenant was sent with all the boats to her assistance.

GETTING UNDER WAY.

On getting on board, he found, from the short and broken sea then running, that it would be impossible to heave the vessel ahead without great risk to both vessels; under these circumstances, and feeling that the captain had intrusted him with this charge, that he might act according to the best of his judgment he took the following method: He made a spring of the *Jaseur's* stream cable on the port side, all the yards were braced up for the port tack, the pinnace was made fast to the stream cable, a sufficient number of men sent aloft to have the topsails and courses ready to let fall at a moment's notice; when everything was quite ready for cutting the cable and spring, and making sail at the same time, the spring was then tautened, so as to bring the wind well on the port bow; the moment she had sheered sufficiently for the sails to stand well, all sail was set together, and the moment she felt her canvas, the cable and spring were cut at the same instant. As she was cast to seaward, the press of canvas she was under appeared to bury her in the very surf, but she was lifted, gathered way, and just grazed clear of the reef, to our astonishment, and my great relief; for, had she struck, not only the brig, but the lives of those on board must have been lost.*

PRACTICAL HINTS ON WEIGHING.

Before getting under way, shift the helm over two or three times, to insure the rendering of the wheel ropes, and that the tiller is clear in its sweep. Have a leads-man in the chains, and the ends of the hawsers clear for pointing, as may be necessary. Range the spare bower cable, having the anchor ready for letting go, and examine the cat-head and shank stoppers.

In purchasing the anchor, have a stout deck tackle in readiness, as also a lashing block, to assist the messenger, if requisite, and reserve new and dry nippers for the moment of bringing up and down. Under such circumstances, as the heave is often heavy, particularly in an anchorage of stiff clay, a "collier's purchase" may be used to great advantage. This is formed by hooking the cat-block to a strap on the cable near the water's edge, and clapping on the fish purchase to the fall, which should be taken to the capstan or windlass. In this way the nip and friction of the hawse-hole are avoided. When unmooring, Glascock recommends putting the whole strain of the ship on the anchor that is weighing, by veering two, three, or four fathoms after the cable is *said* to be up and down. In bringing to (if there be much wind or sea), use *racking* nippers—care being taken not to unbit or unstopper the chain *too soon*. If, on the other hand, there be not

* Liardet.

GETTING UNDER WAY.

much wind or sea, and little strain on the cable, bring to, by commencing to pass the nippers at the hawse hole, and working aft. Then heave in, and when the bight of the cable is taut from the cavil, unbit, and get both messenger and cable on the *upper* side of the cavil. If a nipper jambs, stopper before all, and walk back the capstan, whereby the strain is brought on the stopper, and the nipper relieved. To prevent surging, the turns ought to be kept close and steadily up, and hands stationed at the capstan with flattened levers, to pry the eyes and lashing up when passing round the whelps.

If the anchor should come up *foul*, send a hand over the bow with a stout strap, which must be put around the shank close under the stock, and the cat-block hooked to that in lieu of the ring. When the wind, tide, and the locality of the anchorage, admit of the vessel's casting clear of the shore, shoals, and shipping, it is recommended to defer the operation of loosing sails until the anchor be up, catted and fished, and all the running ropes are coiled, and fairly led, for putting canvas on the ship.

It must be remembered, that a ship which has to *wear* in getting under way, will seldom readily pay off until the anchor is close up to the bow. Therefore, under such circumstances, heave up as briskly as possible. If a ship has a leading wind, and is anchored in a narrow channel, or in the midst of a number of vessels, she should be got under way before the *weather tide* is done, as it would be extremely difficult to cast her upon the lee tide. Should it blow fresh upon the windward tide, so as to force her "end on" over her cable, it would be impossible to heave it in without sheering her over from side to side, and heaving in briskly as the ship slacks her cable; but, as this would be attended with considerable danger by the sudden bringing up of the ship upon each sheer, it would be prudent to heave apeak upon the first setting of the windward tide, and before the ship swings to bring the wind aft.

Lastly, if the ship be towed by a steamer, and *two* tow-ropes are employed and worked at the capstan of the vessel towed, care must be taken to attend the pawls; for, when a sudden strain comes upon the acting hawser, and the pawls of the capstan are not ready prepared to catch, and support the weaker power, the capstan may revolve round at a rapid rate, endangering the limbs and lives of men upon the quarter-deck.

STEAMERS—GETTING UNDER WAY.

The cat and fish-gear being in readiness, call all hands, "bring to," unbit, and heave round. If a long and heavy heave, give a few turns of the engine now and then, or keep the engine turning

GETTING UNDER WAY.

slowly, to assist the bars. Should the anchor prove difficult to break out, give her a turn ahead, sending word to the navigator to stopper the cable. When at a short stay, the ship by moving ahead will certainly trip the anchor, when it may be hove up, catted and fished. The vessel should not "go ahead fast" until the anchor is catted, as it is liable to hook under the fore-foot, endanger the cat-head, &c.

ONE BELL, signifies to go *Ahead slow*,
TWO BELLS, " " *Stop.*
THREE " " " *Back.*
FOUR " " " go *Ahead fast.**

As soon as the anchors are secure, "pipe down," and set the watch to work clearing up the deck, cleaning the anchors and chains, and paying the latter below; secure boats, see the side lanterns in place, and trimmed ready for lighting, &c.

If the steamer had been riding to an ebb tide you may find some difficulty in turning; if practicable, start ahead, and when clear of everything, give a sheer with the helm and run up the jibs to pay her round, or she may be backed astern against a starboard or a port helm, using the jibs and spanker whenever they will be of service.

In a small harbor, or a close berth, a propeller may be turned by putting the helm hard over, when "up and down," and going ahead slowly, the water thrown from the screw having the same effect on the rudder, as if the vessel were going ahead.

STEAM AND SAIL.†

When a steamer goes ahead fast, the vanes are very deceptive, the wind appearing more ahead than it really is. When in doubt, steady aft the trysail sheet or haul out the spanker. Should the latter stand well give the order—

Clear away the fore-and-aft sails!

Man the sheets and halliards! and when all ready, *Haul taut!* HOIST AWAY! HAUL AFT! Hoist the jibs taut up and trim down the sheets. Hoist the staysails and trim aft the trysail sheets. Care must be taken that the main-topmast-staysail does not catch fire from the smoke stack. Should the wind draw aft you may

* Modifications of these will be found very useful: for example, one bell repeated means slower; four bells repeated, full speed; two bells repeated, "done with steam" (after anchoring or making sail); and when under banked fires two bells means "spread fires."

† One effect of the combination of sail with steam power in propelling a ship, is to increase the efficiency of the screw; for as it then has a part, instead of the whole of the resistance of the water to overcome its slip is diminished.—RANKINE.

GETTING UNDER WAY.

try the foresail, and if that stands well, get all the canvas on her that will draw to advantage, excepting the mainsail, which, on account of the smoke stack, remains furled, with its cover on.

To tack a Steamer. Under canvas and steam, should it be required to tack ship, proceed as if under sail alone; if going very fast, slow down before luffing around, otherwise the sails as they fetch aback may bring too great a strain on the fore-and-aft stays. When you "let go and haul," ring to go ahead fast.

To make sail on a Steamer. If ordered to let the steam go down and make sail, send the necessary directions to the engineer, and set all the drawing sail, including the mainsail, as soon as the smoke stack is out of the way.

To reduce sail. If ordered to furl sail and steam, send down to the engineer to get up steam,* raise the smoke stack and lower the propeller, haul up and furl the mainsail, and put the cover on. Fill the fire-buckets aloft. When steam is up, call, *All hands shorten sail!* take in and furl everything, put the covers on and ring to go ahead.

When under steam be particularly cautious not to allow ropes to tow overboard, and in heaving the lead, care must be taken that the line does not foul the propeller. Send the light yards on deck, point the other yards to the wind or brace them sharp up. The topsail yards will soon take against the lee rigging, therefore sway them up about one third and clap jiggers on the lifts, with which steady them down; haul all the rigging taut.

Weather helm. A screw ship under canvas is said to carry more weather helm than a sailing vessel, because the water passes along aft, on the lee side, and finding the screw aperture, passes through it; and thus offering less resistance permits the after part of the vessel to sag to leeward, and the forward part to approach the wind, a tendency which the weather helm is called upon to check; furthermore, it is not only the water which actually impinges upon the rudder which turns the ship; the check received by the water from the rudder is communicated to the water before it for some distance, and this effect is entirely lost with the narrow stern-post of the screw.

DIFFICULTY OF TACKING A SCREW-SHIP UNDER SAIL.

In tacking, as long as a sailing ship has headway, the water coming along the weather side of the bottom strikes the rudder and assists to turn the ship; but, in a vessel with a screw aper-

* Or ring two bells to "spread fires."

ture, the water meets a constant current coming from the lee side through the screw hole caused by the lee way the ship is making, and the side movement of the stern, and is consequently carried off with it at a considerable angle from the line of keel without touching the rudder at all.

ON RUNNING STEAMERS.

The slower a steamer runs the greater distance she will perform with the same amount of fuel, provided she has not adverse tide or head winds to contend with; with men-of-war, therefore, it often occurs that the saving of fuel is a more important consideration than high speed, and for this reason the consumption of coal is reduced far below what would be required to keep the vessel up to her maximum speed.

Again: A body moving through water with a certain velocity, displaces a certain quantity of water in a given time, with a certain velocity; if the velocity be doubled, the quantity of water displaced will also be doubled, because the body moves double the distance, and each particle of water will, therefore, be displaced with double velocity; hence the resistance to the body will be as 2×2, or as the square of the velocity. Thus, it appears that, if a ship consumes 500 tons of coal to perform a certain distance, at the rate of 5 miles the hour, to perform the same distance at the rate of 10 miles the hour, would require $5^2 : 10^2 :: 500 : 2{,}000$ tons, or four times 500; but the quantity of coal required for any one day, at the rate of 10 miles, will not be four times the quantity required at that rate for 5 miles, but will be 8 times; for supposing the speed be increased to 10 miles the hour, the same distance will be performed in 5 days; hence we have in the first case, 500 tons consumed in 10 days = 50 tons per day, and, in the latter case, 2,000 tons in 5 days = 400 tons per day, or 8 times 50 tons. Now then taking the coal as the exponent of the power, we see that the power has to increase as $2 \times 2 \times 2$, or as the cube of the velocity. Hence the importance, wherever speed is not an object, of running the engines as slow as possible, in order to economize fuel.

But whenever there is an adverse current to contend with, the most economical speed is *half as fast again as the current*. That is to say, if the velocity of the current be four miles the hour, the velocity of the vessel should be six miles.

Let 1 represent the power required for a speed of 1 mile per hour: then, inasmuch as the power increases as the cube of the velocity, the power required for the speed of 6 miles $= 6^3 = 216$, and the ground moved over $= 4 - 2 = 2$.

GETTING UNDER WAY.

Suppose now the velocity of the ship be reduced to 5 miles per hour, the power will be $= 5^3 = 125$, and the ground moved over $= 5 - 4 = 1$.

Suppose, again, the speed to be increased to 7 miles per hour, the power will be $= 7^3 = 343$, and the ground moved over $= 7 - 4 = 3$.

Summing up these figures, we have for a speed of 7 miles per hour a power expended of 343, to make good a distance of 3 miles $= 114\frac{1}{3}$ per mile; for a speed of 5 miles a power of 125 to make good 1 mile $= 125$ per mile; and for a speed of 6 miles, 216, to make good 2 miles $= 108$ per mile. Consequently the least power is required at the speed of 6 miles, which is half as fast again as the current.

These calculations apply alike to head winds, &c., at sea, as well as to a tideway in a river: whence it follows that a vessel can be run even too slow for economy, but nevertheless, when having a heavy head sea to contend with, there are other elements besides economy of fuel to be taken into consideration; the strain upon the vessel and machinery, the plunging and staving in of the light work about the bows and other places, shipping of seas, &c., are matters which also require the judgment of the commanding officer.*

NOTE. When making sail on a steamer, the senior engineer should be duly informed with regard to the engine, that he may "haul the fires," or bank them, as occasion requires. *Heavy banks* are such that the fires may be spread and steam got up in a little while; *light banks* require more time to get ready.

SCHOONERS.

In getting a schooner under way, the general rule is to hoist the mainsail first, and when the chain is "up and down," to hoist the jibs to cast her.

Should the schooner have a boom foresail it may be set with the mainsail.

If a topsail schooner, the topsail may be set and braced abox, as on board a square-rigged vessel.

The exception to the rule in hoisting the mainsail first, is, when intending to stand out before the wind, in which case, heave up, hoist the head sails, and when pointed fair, hoist the mainsail, or, having the mainsail up, drop the peak to let her wear. Tack-

* Practical Notes on the Steam Engine, J. W. King, Chief Engineer, U. S. N.

GETTING UNDER WAY.

ing a schooner with a boom foresail requires generally two men, one at the helm and the other to catch a turn with the jib-sheet, so that it may not go over to leeward too soon, but pay her off. At the order, *Draw jib!* or, *Let draw!* the rope's end which held the sheet to windward is let go, when it flies to leeward on the traveller; the fore and main sheets work on a traveller and need no attention.

When about head to wind with a lug-foresail, order, *Draw foresail!* when the weather sheet is flattened aft, taking care not to make a back sail of it. The topsail is worked as on board a square-rigger, and by the same orders.

Having the wind on one quarter, and by a change of course or wind it is brought on the other, the main boom must be got over and the operation is called *gybing*. To *gybe* a main boom, blowing fresh, is an operation requiring much skill, as it is not unfrequently attended with accidents, such as the wrenching off of the head of the mainmast. To lower it and hoist again after changing the course is the safest plan. If not blowing fresh enough to lower the sail, then give the schooner a little lee helm, bring the wind a point or so on the quarter, and trim flat aft the main sheet, catching a good turn with it; now with a small and steady helm, bring the wind aft again, and then on the opposite quarter, when the boom will gybe and the main sheet may be eased off as required for the new course.

To Heave a Schooner to, brail up the foresail, haul flat aft the main sheet, and haul the jib-sheet to windward; if a boom foresail, ease off fore-sheet to spill the wind out of the sail.

HANDLING A SCHOONER IN BAD WEATHER.

In a gale of wind, a sharp-built schooner is hove to under the double-reefed foresail; the sheet of which should be hauled as flat aft as possible, not only to prevent the vessel from head-reaching too much, but to keep the sail from shaking, when she comes up to the wind. While the foresail is kept full, the vessel continues to head-reach, whereby a constant action of the water is maintained on her rudder; and this prevents her from falling off into the trough of the sea. If the vessel is very sharp in her construction, and it is seen that she has a tendency to head-reach too fast, it is then necessary to hook the weather-sheet, and haul the sail amidships.

In some sharp-built schooners, it is frequently essential to hoist the head of the mainsail, to assist in keeping them to. The

helm must not then be put hard down, but a little to leeward, or only as circumstances may require. In sailing such a vessel *by* the wind, when blowing in squalls, it is usual to "touch her up" in the wind; but if the wind should prove variable first on the quarter and then a head, to luff the vessel in this manner would be attended with danger. Sail ought therefore, in such an event, to be made *snug;* for if a squall should come suddenly on the quarter, it will be too long a luff before the sails touch; and if it comes out ahead, they will then be thrown aback.

A flat-built schooner is often hove to under a balance-reefed mainsail; but if this be done she must be very flat, and when she will not lay-to, in any way, under a foresail; so that while she is under a balance-reefed mainsail, she will come up and fall off; the after sail will bring her up when she loses her headway, and then gathers sternboard, and the helm by being a-lee will cause her to fall off, before she has time to fill and get headway. Then, with the wind on the quarter, she runs ahead with violence, until she again comes up as at first, and thus she will continue to come up and fall off. But on account of the flatness of her bottom, and its consequent little hold upon the water, she will drift so fast the sea will be made smooth, and therefore cannot reach her. But should a sharp-built vessel fall off in this way in the trough of the sea, her decks would be in great danger of being swept.

Shallow-built vessels, and such as have flat floors, are much more liable to be upset in a heavy sea than those of a different construction. This arises from their having so little hold upon the water, notwithstanding their great stability in a river, or smooth sea, where it would be almost impossible to capsize them in carrying sail. Dutch galliots, for this reason, are often upset by a heavy lurch, and when the sea strikes them under the bottom.

One or two points more. It must be recollected that the *lee* sheet of a schooner's topsail should be the first clewed up, otherwise it may get over the lee yard-arm, on account of the sail having proportionally more spread at the foot than square-rigged vessels in general. Again, a schooner's weatherbraces must not be too *taut*, from the liability to part, or to carry away the yard, by the spring of the masts, &c. A careful person ought to be at the helm of a schooner in carrying sail in squally weather, when it is necessary to luff and touch the sails. At such times the *square* sails should be furled.

Lastly, in tacking a schooner, much depends on working the lug-foresail briskly. It should be hauled over, while head to wind, as quickly as possible, but *never* to make a *back* sail.

CHAPTER XXII.

IN A TIDEWAY.

DRIFTING—CLUBBING—BACKING AND FILLING.

In drifting or working down a river, with a strong tide, great care is necessary to prevent falling afoul of other vessels which may be at anchor on the way, or to avoid endangering the vessel on rocks, shoals, &c.

With the wind directly in the harbor, or partly across the tide, the current running out, you may *work* out by tacking from shore to shore; let her *drift* out broadside to the current; or, having her under the direction of the helm, by sufficient sail set to give her good way through the water, keep her head to the current, and drift down stern on, or you may *club* her down.

Bear in mind, in every evolution performed in a tideway, that the after part of the keel being more deeply immersed in the water, and presenting a broader surface to the action of the current than the forward, the stern of a vessel will always have a tendency to drift faster than the bows.

If the wind should be partly across the tide, she should be cast, in getting under way, with her head towards the weather shore.

After getting under way, which is sufficiently explained in the preceding chapter, keep her head to the current, by sufficient sail, until the anchor is catted and fished.

And never weigh the anchor until the sails are so arranged that the vessel will be immediately under the influence of the helm.

If you have room, you may then proceed to bring her by the wind, make sail, and work her down as in the common evolution of working to windward, making an allowance for the strength of the current, in approaching any vessel, or either shore, and in giving yourself sufficient room for stays.

Should the wind be across the tide, you may approach the weather shore boldly; for should you miss stays, you have recourse to wearing or box-hauling. But approach the lee shore cautiously, always leaving room to recover her and gather headway, to go in stays a second time.

IN A TIDEWAY.

Avoid standing into eddy currents on either shore; they may be plainly distinguished by the worried appearance of the water; for a vessel, when in their influence, is at their mercy, and quite out of the management of the helm or sails.

If you approach a narrow passage, or the anchorage of a number of vessels, bring her head to the current, bracing the yards full, and keeping only sufficient sail on to give her good steerage-way through the water, that you may sheer her to either side; and, in this manner, she will drift down with the current, past or between any vessel or shoals. This is the best, being the safest method for a narrow channel.

And arriving again at an open space, you may bring her broadside to the current, keep the topsails shaking and the helm a-lee, and presenting only the surface of the spanker to the wind, which will serve to counteract the force of the current upon the stern. In this manner she will drift more rapidly than by the former method. By filling the head yards and taking in the spanker; or by filling the after yards and brailing up the jib; or by bracing "*all aback*," using the helm as necessary, you can, at any time, have her under control, shoot ahead, back astern, or bring her head to the current.

CLUBBING.

Clubbing is recommended for smaller vessels in a rapid river; you may heave in the cable until the anchor is under foot, when she will drift down by the force of the current, veering out or heaving in the cable as she deepens or shoals the water, or as you may wish to diminish or increase her drift, see Fig. 395, Plate 77. Vessels drifting in this manner, generally have a spring from the ring of the anchor, leading in at one of the quarters, so that by veering on the cable and rousing in the hawser, you may present her broadside to the current. This is termed *clubbing* a vessel. Though, from the danger of fouling the anchor against rocks, or other matter, and the inconvenience of the operation, one or other of the previous methods should be resorted to, in preference to this.

Clubbing is such a simple manœuvre, where the sets of the tides are known, that it is only necessary to observe that a ship at anchor, with a tide running past her, is as much affected by a motion of the helm, as if she were reaching at the same rate under canvas; therefore, if a ship's helm be put over one way or the other, she will answer to it, and shoot across the tide, taking her anchor with her, if there be short enough scope, so by heaving in to that scope, and putting the helm hard over, she will

PLATE 77

Fig. 395

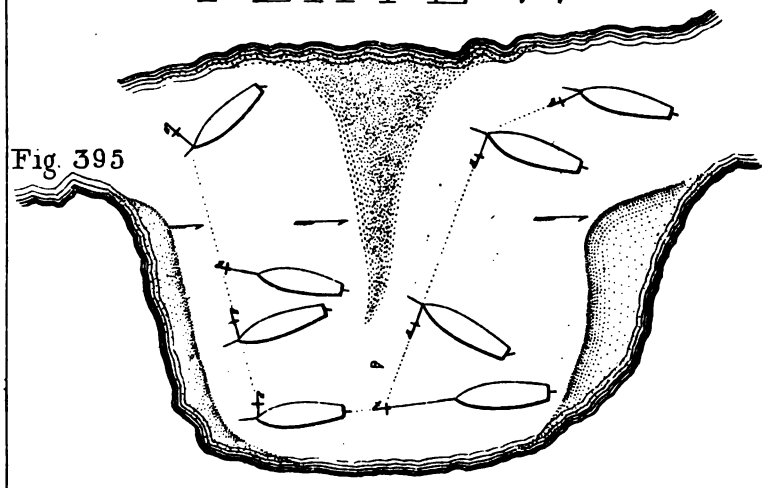


Fig. 396

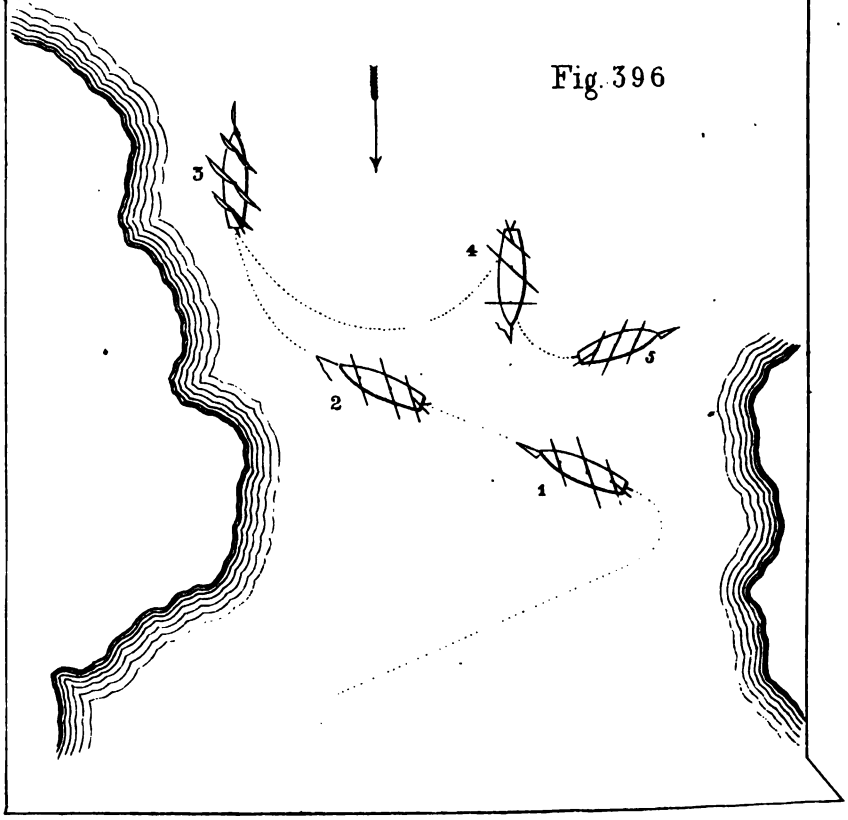
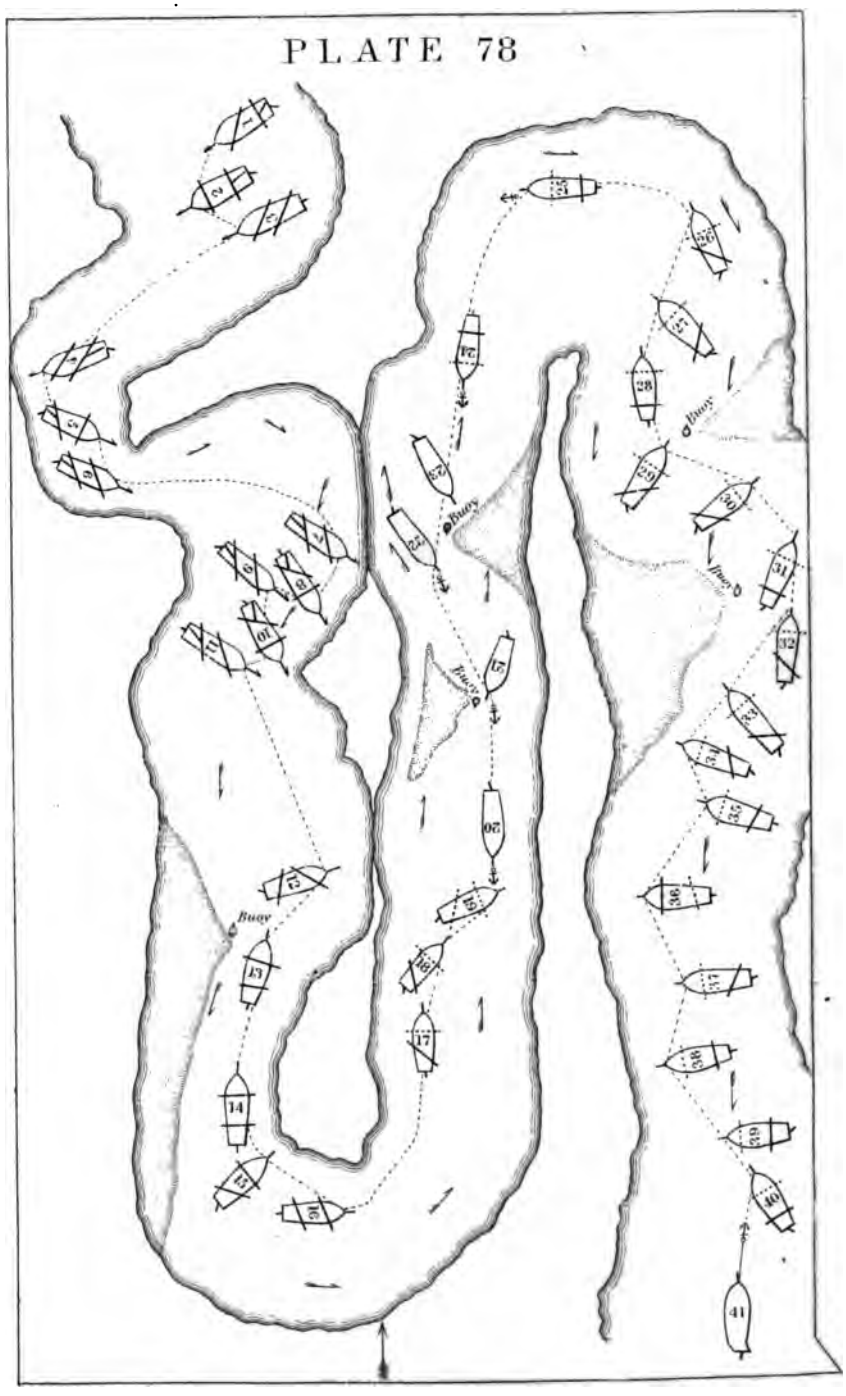


PLATE 78



IN A TIDEWAY.

cross the tide without losing much ground; hence, although, as represented by the arrows in Fig. 395, the tide sets directly over the sands and athwart the deep water channel, yet by sheering her as far as she will go, and bringing her up when she begins to lose ground, she may be dropped down, or sheered across any channel against the wind, where she might otherwise wait months for a fair wind to sail down. It is scarcely necessary to observe, that she will sheer to port more readily with her starboard anchor down, and *vice versa*.

BACKING AND FILLING.

Before steam-tugs were so plentiful, vessels relied upon the tides, in many instances, to get them to sea.

You may drift a vessel down broadside to the current, keeping the yards counter-braced as in lying-to, shooting ahead, or backing astern to avoid danger; then, as you approach either shore, you may fill away until she gathers sufficient headway for stays, or wear around, putting her head towards the other shore; this is termed *backing and filling*.

To do this properly, a knowledge of the times and sets of the tides, depth of water, eddies, &c., and especially a correct judgment of distance, are of the first importance.

To give a clear idea of the various manœuvres, and show what can be done with a ship without steam, a sketch (Plate 78) is given of a vessel backing and filling up a narrow channel, with the wind and tide in every possible different position with respect to each other.

The wind and sets of the tide are designated as before by arrows and half-arrows, and the vessel's track or course by the dotted lines from number to number. No. 1, Plate 78, represents a vessel reaching across the tide with her main yard aback to avoid reaching too fast; proceeds to No. 2, having reached out of the strength of the tide, has thrown her fore yard aback, and is making a stern board, by which she will fetch No. 3, fills and reaches to No. 4, tacks, the tide sweeping her while in stays round the point, but not sufficiently soon to enable her to fill on the starboard tack; the fore yard therefore kept aback, as in No. 5, while the tide is setting her to No. 6, fills; the tide in this reach setting to leeward, she does not make a weatherly course until she meets it running to windward again, when she reaches to No. 7, where the helm is put a-lee and the main yard swung, and she shoots into the position of No. 8, is not permitted to come round, but falls off again, and makes a stern board to No. 9, fills and reaches ahead as far as she can, then repeats the

manœuvre of No. 7 to No. 10, whence, as before in No. 8, she makes a stern board to No. 11, where she is in a "fair-way," and will maintain her position in the strength of the tide, by backing, filling, or shivering the main yard, or both, till the tide sets her into the position of No. 12, where she is being brought astream of the tide, to drop stern first under better command, through a channel which is too narrow to allow her to drop athwart.

From No. 11 she might have reached into the bight, and tacking there, have fetched as far to windward as No. 13; but there being an eddy tide in the bight, she would perhaps have lost half the tide before she got out of it again, unless she had a commanding breeze.

No. 13, being astream of the tide, is dropping through the narrow channel to No. 14, and thence to No. 15, where she is hauling her wind on the starboard tack to No. 16, in a "fair-way" to No. 17, where the tide is setting to leeward, and the fore-topsail is clewed up, as she is going to bring up, there not being sufficient water for her to proceed; the main yard is therefore braced up to take aback, that when she rounds to, as in No. 18, she may not shoot across on to the opposite bank.

No. 19, the main-topsail being clewed up or down, the anchor is let go, and the vessel swings head to wind and tide, as in No. 20; having to wait a short time here till there is sufficient water for her in the next channel, the jib-boom is rigged in and the fore-topsail furled, as she is coming to a more crowded part of the river, and does not require to reach any distance. When there is sufficient water for her to proceed, known perhaps by the time of tide, or by the water she is riding in, or if it be a shifting channel by a boat stationed there, the cable is hove in and she clubs to No. 21, where she is sheering across the channel to No. 22; the tide here setting into the bight, she is obliged to sheer broad to port to prevent her being set in there.

No. 23, the helm aport to bring her astream again, clubs to No. 24, has got the main-topsail set again to help her to No. 25, wind abeam, main-topsail shivered, or backed as required till she arrives where the tide is setting to windward, as in No. 26, heaves up and drops, filling or shivering the main yard, to No. 27, clear of the buoy, is brought astream again, as in No. 28, and dropped to No. 29, hauling her wind to cross the tide, as in No 30, where the main-topsail full prevents the tide from setting her upon the sand astern, when she fetches No. 31, is again brought astream and drops to No. 32, where she is again laid athwart and drops fore-reaching a little with her main yard full, as in No. 33, and thence to No. 34, where the main yard is laid aback for a

IN A TIDEWAY.

stern board to No. 35, whence, by backing, filling, or shivering the main yard, either to keep in the best of the tide, or to make way for other vessels passing up or down the channel, she arrives as in the following figures at No. 39, where she is again laid astream and the main-topsail clewed up, as in No. 40, where she can drop her anchor and ride to windward or to leeward, according to circumstances.

Native pilots, from their intimate knowledge of their rivers, have to be relied on in a great measure for success in these evolutions. The Chinese pilots, in Canton river, are very skilful in the management of ships. In December, 1845, one of them piloted the "Columbus," 74 (drawing twenty-three feet six inches), up the Boca Tigris channel, on which occasion she was drifted up with the flood, under her three topsails, using the jib and spanker as required.

CHAPTER XXIII.

AT SEA.

THE OFFICER OF THE DECK.

On getting clear of the harbor, the first lieutenant causes everything about the decks to be secured for sea; the navigator, upon receiving the order, secures the anchors, and, if a long passage is anticipated, the chains are unbent and the hawse-bucklers put in. If the chains are not unbent the hawse-pipes are closed by means of *jackasses* (canvas-bags stuffed with oakum). The chains after being cleaned, are paid below. Dry, and stow away the nippers, hawsers, &c., pay below the messenger, and, in short, restore to its proper place everything used in getting under way.

If the vessel be under sail alone, the anchors and chains are kept ready for use until a good offing is made.

On piping down from getting under way the first lieutenant turns the deck over to the officer having the watch, who is at once to acquaint himself with the position of the ship, her condition, and all orders remaining to be executed.

Before losing sight of the land, the navigator takes the departure, puts over the patent log and sets the course, when the officer of the deck will commence heaving the log and marking the log-slate. The chafing gear will now be put on, the boats topped up and secured, and, if not done before leaving port, the studding-sail gear will be rove.

An outline of the daily routine at sea will be found in the Internal Rules and Regulations of the ship, but a few minor details may be here mentioned. Let it be supposed that an officer is called at 4 A. M., to keep the morning watch. Five minutes is a fair time for him in which to relieve the deck. Having received all the orders, information, &c., he will, on the watch being reported up, and the wheel and lookouts relieved, cause the previous watch to be "called," and the watch on deck to be mustered. In the meanwhile he "passes the course" to the man at the wheel, looks at the compass if going free or under steam, or at the sails if "full and by" and this he should frequently repeat during the watch. After the mustering of the watch it is well to make a rapid survey of the deck, to see that the yards and sheets are properly trimmed, weather lifts and braces

taut; lights burning brightly, lookouts properly stationed, and to give any cautionary orders to the officer of the forecastle he may deem expedient, such as to have the top-gallant clew-lines led along, keep a bright lookout a head, &c.

The lookouts at sea are generally as follows: a forecastleman on the starboard cathead, a foretopman on the port, a maintop-man in the starboard gangway, an afterguard in the port, an afterguard on the starboard quarter, and a mizzen-topman on the port. When the "quarter watch" is aloft, one hand in each top keeps a lookout, and under certain circumstances a forecastle-man may be stationed on the fore-yard. In "passing the hail" which is done every half hour, the lookouts call the name of their station in regular succession, beginning at the star-board cathead, and ending with the mizzen-top. Men may also be stationed on the main and main-topsail yards to guard against sparks from the smoke-stack. The men on the quarters besides keeping a lookout are responsible for the life-buoys, and they should be instructed how to light and to detach them.

The weather-wheel is generally taken by picked men from the forecastle—while afterguard are sent to the lee-wheel. Sea-men who have a regular "trick at the wheel," do not stand a lookout. Besides the lookout, men are stationed by the halliards and main sheet day and night.

The wheel and lookouts are relieved every two hours; in very bad weather it is well to reduce this to one hour.

Each watch is divided into two equal parts, 1st and 2d, and known as *quarter watches*. The quarter watches take regular turns in going aloft; but at night, when the light canvas is spread, it is well to give the command, *Lay aloft the quarter watch!* to insure their being in the tops.

At sea, particularly in hot weather, the men should be made to "lash and carry," that is, but one watch of hammocks should be piped down at a time, and when one watch is called, they should lash up and stow their hammocks, the other watch taking theirs below when relieved. This keeps the decks below comparatively clear for quarters, and is healthier for the men than "turning in and out."

The captain of each part should be supplied with a list of his men. Petty officers may generally be relied upon to muster their own parts and to report absentees.

If there are any midshipmen on deck, it is their duty to muster the watch. In doing this the men should be required to toe a seam, and as each one answers to his number, to fall out of the line and pass the mustering officer. The same form should be

observed with the life-boat's crew, which should be kept together, and the coxswain required to report the boat clear.

The very great advantage of calling the watch ten or fifteen minutes before eight bells, giving the men time to prepare for their watch, and to be mustered before the time for relieving, may be here reiterated (see Organization, p. 312). It would add to the health and comfort of the crew, to the safety of the ship when under sail, and relieve the mind of the officer of the deck of the anxiety felt during that painful interregnum when neither watch feel it incumbent to "man the main clew-garnets and buntlines," let it look never so squally to windward.

The habit cannot be too earnestly recommended to the young watch officer of anticipating various emergencies and casualties, such as a man falling overboard, parting rigging, &c., &c., and determining what should be done in each event, that when it does occur, the right order may burst involuntarily from the lips, and the mind be fully prepared for the necessary evolution.

The habit may be cultivated while young, and will be found of the utmost advantage. An officer, while in charge of the deck, should never allow his thoughts to wander from the subject of his immediate duties, to which end it would be well, during his earlier years, to adopt as an invariable rule the resolution never to think of anything but *seamanship* while actually on watch.

The orders of the executive officer, in reference to washing clothes, scrubbing decks, &c., called morning orders, and usually written in an "order-book," are put in execution immediately after mustering the watch, unless trimming yards, or other essential duties, or want of light prevent. If clothes are to be washed, the boatswain's mate is ordered to call the "watch scrub and wash clothes," and the command given to "*lay up the rigging fore and aft.*" A certain time should be allowed for washing—not over an hour—and the clothes should be neatly stopped on the lines so as to lap, each piece, by an inch or two, the white and blue separate, the former always being above or on a different set of lines, that they may not be soiled by the dripping of the latter.

At daylight the order is given, *Come down from the lookout!* and *Lookout to the mast-head!* The lights are taken in, forward officers called, and the master-at-arms directed to turn out and report up the idlers.

The mates of the decks get their orders from the officer of the deck. If the main deck is to be washed, the "second part of the watch" is sent below. But if under sail, an officer should be

cautious not to allow the watch to become so much engaged, or the running rigging so encumbered, that the sails may not be readily handled, or the yards braced in any sudden emergency.

At six or seven bells the boatswain will be directed to "call all hands and pipe the hammocks up," after which proceed to get all the sheets close home and the sails taut up, tops put to rights, hammock cloths and boom cover smoothed over and stopped down, bright work cleaned, chains swept out, pea-jackets put in their bags and stowed away, &c., &c.

An officer should never leave anything to be done by his relief which he should have performed himself.

At dusk the command is given, "Station the lookout," and "Lay down from the mast-head"—the lights are lit, &c., &c.

Half an hour before each meal the ship's cook makes his report at the mast; before breakfast and supper that "tea-water is ready for serving out," and at 11.30 that dinner is ready for inspection. If nothing has occurred to interfere with the regular meal hours he is ordered to "serve out."

Everything affecting the health and comfort of the crew should receive the earnest attention of the officers. There are minor points of duty which no rules or regulations can reach, and which must be left to the thoughtfulness and good sense of the officers themselves. Thus a considerate officer will anticipate a rain-squall, and get washed clothes or scrubbed hammocks down in good time. He will not commence an all-hands job fifteen minutes before twelve o'clock, and send the men down to a cold dinner at one bell. Boats and working parties will be recalled in time for their meals; timely preparation will be made for rain that the men may not be exposed to it unnecessarily—a dry place reserved for the watch below, &c., &c.

By a little attention to these and like matters a crew is rendered contented, and good discipline is more easily maintained.

MAKING AND TAKING IN SAIL.

Young officers should make themselves familiar with the lead of the running rigging, where it belays, &c., and on first getting to sea, it is well to exercise the crew at manning the ropes, that they may learn their lead and be enabled to find them on the darkest night.

To set a Foresail, give the order—

Man the fore-tack and sheet!

MAKING AND TAKING IN SAIL.

At this command the men jump to their stations, the fore-tack and sheet are manned, one hand being by each clew-garnet, and the buntlines and leechlines let go.

Lay down on the fore-yard and overhaul the rigging!

At this order, one or two of the topmen lay down, and overhaul, through their blocks, the buntlines and leechlines.

If the weather is moderate, as soon as the officer of the deck sees that the men are at the stations, he orders—

Clear away the rigging! HAUL ABOARD!

At this the clew-garnets are let go, the tack hauled forward, and the sheet aft.

The Mainsail is set in the same manner, substituting *main* for *fore;* and to get the tack close down, it is advisable, if the yard is braced sharp up, to ease off the lee main brace, and overhaul the weather clew-garnet, weather main-topsail clewline and main lift. After the tack is down, brace up the yard, haul taut the lift and truss;* reeve and haul the bowline.

When the yards are square, and the wind directly aft, the mainsail is never set, but is hauled up snugly; with the wind quartering, the lee clew may be set to great advantage. To do so, *Man the main sheet! Let go the main buntlines for'd!* The buntlines, leechlines, and slabline, are let go and overhauled.

Ease down the lee clew-garnet! HAUL AFT!

The weather clew is kept fast.

To set the Foresail before the wind—

Man both fore sheets!

The rigging being let go and overhauled as before, order—

DOWN FORESAIL! As the sail comes down, take through the slack of the tacks; haul taut both lifts and trusses.

To set the Courses, order—

Man the fore and main tacks and sheets!
Lay down on the lower yards to overhaul the rigging!

When the ropes are reported "all manned"—

Haul taut! Clear away the rigging! HAUL ABOARD!

To take in a Course in moderate weather. If a foresail, order, *Man the fore clew-garnets and buntlines!* The clew-garnets,

* Trusses here refer to the old-fashioned trusses of hide-rope. The word has been retained, in some instances, on account of there being still some ships in commission with their yards rigged in that way.

buntlines, and leechlines being manned, men stationed at the tack, sheet, and bowline, order—

Haul taut! UP FORESAIL!

The tack, sheet, and bowline, are let go, the clews of the sail are run up by the clew-garnets, the body by the buntlines, and the leechlines confine it snugly to the yard.

In a fresh breeze, or gale of wind, it is necessary, in order to avoid shaking or flapping the sail, which may split it, to proceed thus: If you wish to set a course, the yard being braced up; everything being manned, order—

Ease down the lee clew-garnet! HAUL AFT!

Then when the clew is sufficiently aft to fill the sail—

Ease down the weather clew-garnet! HAUL ABOARD!

To take it in, under similar circumstances, the men being stationed, order, *Ease off the fore-tack and leechline!* HAUL UP TO WINDWARD! Then, *Ease off the sheet!* HAUL UP TO LEEWARD! Having the buntlines well manned, run them up the moment the sheet is started; the lee clew being the first set, and the last taken in, steadies the sail during the operation.

Setting courses, when trimming forward, it is better to get the tacks down before the lee braces are near their marks.

On setting courses by the wind, before hauling aboard, check the lee braces, for the bunt of the sails may nip or be jammed between the yard and the stay, and at all events, the tacks will come down better.

To prevent mistakes in the leechlines, it is advisable to lead their hauling parts differently, thus: the after ones through leaders by the masts, and the forward ones through leaders at the side.

Topsails are the first sail set in getting under way, under ordinary circumstances, and the last taken in, in coming to anchor, except the spanker. At sea they remain constantly set, are reduced by reefing, in fresh winds, but never taken in except in gales of wind, or for the purpose of repairing or unbending. The mizzen topsail is an exception, inasmuch as it is often settled down on the cap or furled, when sailing with the wind directly aft, and often taken in in heavy weather, when the fore and main are close reefed.

To set a Topsail. The yard being square and on the cap, order—

Stand by to lay aloft, sail-loosers of the main (fore or mizzen) top-sail! LAY ALOFT! *Man the boom tricing-lines!* When the men are aloft, TRICE UP! LAY OUT AND LOOSE!

MAKING AND TAKING IN SAIL.

The heels of the top-gallant studding-sail booms are triced up, the men lay out on the yard, and loose the sail by casting off the gaskets. While doing which—

Man the topsail sheets and halliards! Tend the braces!

The clew lines are tended and buntlines let go, and overhauled aloft, the gaskets cast off, the bunt-jigger unhooked, and the men on the yard holding up the sail by hand, it is reported *ready*. The sheets being well manned, the order is given, *Stand by!* LET FALL! SHEET HOME! LAY IN! DOWN BOOMS! *Lay down from aloft!* The clews of the sail are hauled out to the lower yard-arms by the sheets, until the foot of the sail is taut, hands *easing* away the clewlines as the sheets go home. This is much preferable to letting them go *by the run*.

HOIST AWAY THE TOPSAIL!

The yard is hoisted by the halliards, until the leeches of the sail are taut, keeping the gear well overhauled.*

To take in a Topsail, as in coming to anchor. *Man the topsail clew-jiggers and buntlines! Weather braces!* At this order, the clew-jiggers and buntlines are manned; hands stationed by the sheets, halliards, bowlines, and braces; the latter for the purpose of squaring the yards if braced up; have a hand on each lower yard-arm to render the sheets through their sheaves; order, *Clear away the topsail sheets, clew up!* The clews are hauled up by the clew-jiggers, and the body by the buntlines; when the sail is up, and the weather braces manned, *Settle away the topsail halliards! Square away!* The yard is now lowered on the cap and squared in at the same time, the buntlines and clew jiggers are kept some distance above the yard, and the leeches passed in ready for furling.

Down-haul Tackles,† are used only in the larger sized vessels, for the purpose of rousing the topsail yard down, when the halliards are let go. In ordinary cases the yard will come down by its own weight, assisted by the clewlines; but when the sail is *rap* full, in a squall, binding the parrel against the mast, or being aback binding against the rigging, or when the tye is jambed in the gins at the mast head, the assistance of a downhaul tackle is necessary.

To take in a Close-reefed Topsail in a Gale. Man the clew-lines, buntlines, and weather braces; tend the sheets, lee brace and bowline. When ready, *Ease off the weather sheet and bow-*

* The sail sheets home better if the yard is hoisted at the same time.

† Obsolete.

line! Clew up to windward! Mind the weather helm to keep the sail from shaking. When the weather clew is up, *Ease away the lee sheet, clew up to leeward!* Running up the bunt lines at the same time, bracing aback and clewing down the yard the moment the lee sheet is started.*

To set a close-reefed Topsail under similar circumstances. Brace up the topsail yard sufficiently, and the lower yard more than the topsail yard. Haul taut the lee topsail brace, then *Lay out and loose! Man the topsail sheets!* Attend the gear, let go and overhaul the buntlines, *Ease down the lee clewline, haul home the lee sheet!* keeping the vessel off if necessary; then, *Ease down the weather clewline, and haul home the weather sheet!* Man the halliards and sway the yard clear of the cap. Trim the yards, haul taut the weather-brace and rolling-tackle, and haul the bowline.

To take in a Topsail in a gale. (*Another Method.*) Say the fore: *Man the fore-topsail clewlines and buntlines, weather fore-topsail brace!* The weather clewline is manned best; hands by the lee brace, sheets, and halliards—topmen aloft to take off lift-jiggers; when ready, keep the ship off a point, ease off a fathom of the lee sheet, *Settle away the halliards!* BRACE IN AND CLEW DOWN! *Ease away the weather sheet!* CLEW UP TO WINDWARD! The weather clewline and *both* buntlines are run up; *Ease away the lee sheet!* CLEW UP TO LEEWARD! The weather brace is hauled in when the yard is clewed down. Point the yard to the wind, steady it well, and furl the sail.

To take in a close-reefed topsail with the wind *abaft the beam*, haul up the *lee* clewline first; brace the yard in by the weather brace until it is pointed to the wind, if possible, before laying out to furl.

In taking it in *before the wind*, with the watch, haul up one clew at a time, hauling up *both* buntlines as before; brace the yard sharp up and bring the wind on the quarter; then lay out and furl the sail.

In taking in the sail with all hands on deck, the best way is to ease off *both* sheets together, and walk up *all the gear*, hauling in the weather brace at the same time; but before attempting this, the officer of the deck must be sure of being able to walk the gear up *without stopping*, for if it once commences to flap, all command of it will be lost, and it will blow away.

* When a topsail is close reefed, the yard is generally as far down as it should be in bad weather, and will not require to be "clewed down."

MAKING AND TAKING IN SAIL.

In furling a sail in a gale, secure the yard well before sending the men out; and when out, render them all the assistance possible with the *helm*.

To take in and furl the mizzen-topsail in a gale. *Man the mizzen-topsail clewlines and buntlines, lee mizzen-topsail brace!* Hands by the sheets and halliards, weather brace and bowline. When ready, *Settle away the halliards!* CLEW DOWN! Hauling in on the lee brace; *Ease away the sheets!* CLEW UP! The yard is pointed to the wind, and the gear hauled close up; *Lay aloft all the mizzen topmen!*

LAY OUT AND FURL THE MIZZEN-TOPSAIL!

To set a Top-gallant sail. Order, *Lay aloft and loose the fore (main or mizzen) top-gallant sail! Man the top-gallant sheets and halliards!* While the sail loosers are loosing the sail, the sheets and the halliards are manned, hands being by the clewlines and braces. When ready, *Stand by!* LET FALL! *Lay in!* SHEET HOME! While hauling home the sheets, if on the wind, brace up the yard sufficiently to shake the sail; take a turn with the weather brace, and let go the lee one. If before the wind, let go both braces; and if the wind is quartering, the lee one. *Tend the braces!* HOIST AWAY! Hoist the sail up "a taut leech," *Belay the halliards!* Trim the yard to the wind, set taut the weather brace, keeping the lee one a little slack, and haul the bowline.

To take in a Top-gallant sail. *Man the fore (main or mizzen) top-gallant clewlines! Weather fore-top-gallant brace! Lay aloft to furl the fore-top-gallant sail!* When the clewlines and weather brace are manned, hands by the sheets, lee brace and bowline; if in a moderate breeze, order, *Haul taut!* IN FORE-TOP-GALLANT SAIL! The sail is clewed up, halliards let go, and the yard braced in at the same time. In a fresh breeze, order—

Let go the lee sheet and halliards! CLEW DOWN! rounding in at the same time the weather brace. *Let go the weather sheet and bowline!* CLEW UP! If the wind is aft, or on the quarter, order, *Let go the halliards!* CLEW DOWN! *Let go the sheets!* CLEW UP! Squaring the yard as it comes down by the braces, and starting the sheets when down. The sail being clewed up, steady the yard by the braces, and then order, LAY OUT AND FURL!

The three top-gallant sails are set and taken in, in the same manner, giving the order, *Lay aloft and loose the top-gallant sails!* and *Man the top-gallant clewlines*, &c., &c.

MAKING AND TAKING IN SAIL.

Line-of-battle ships and frigates, and sometimes sloops-of-war, have buntlines to their top-gallant sails, which, in a heavy sail, are absolutely necessary, to haul up for furling.

To set or take in the Royals. Proceed as with the top-gallant sails, in moderate weather. The flying-jib generally goes with the royals, and the following are the orders—

Aloft and loose the royals! Clear away the flying-jib! When ready—

LET FALL, SHEET HOME! HOIST AWAY THE ROYALS AND FLYING-JIB!

To take them in, *Aloft and stand by to furl the royals! Man the flying-jib downhaul! Haul taut!* IN ROYALS, DOWN FLYING-JIB! FURL THE ROYALS! STOW THE FLYING-JIB!

The royals are generally set, and taken in, by the quarter-watch, aloft.

Flying Royals* are used in the smaller vessels, and, occasionally, in sloops-of-war. In setting, the halliards are bent to the slings of the yard, and stopped out to the yard-arm opposite to the side on which it goes up, and a tripping-line to the other yard-arm. *Sway aloft!* When high enough, the sheets, previously rove through the sheave-holes in the top-gallant yard, are toggled to the clews of the sail; the yard-arm stop cut, and sail loosed; the sheets and halliards being manned, *Sheet home! Hoist away!*

To take it in. The tripping-line, which is kept bent to the yard while the sail is set, leads down on deck on the weather side. *Stand by to take in the royal!* The tripping-line being manned, hands by the halliards and sheets, and two hands aloft to untoggle the sheets; order, *In royal!* The sheets are let go, the sail lowered by the halliards, and hauled down by the tripping-line. The men aloft untoggle the sheets from the clews as it comes down; the sail is either secured up and down the topmast rigging, or, which is more common, sent down on deck, and stowed, after being furled, in the boats.

When a vessel carries a flying royal, she rarely carries any sail above it; but with a standing royal, which is set and taken in as a top-gallant sail, skysail, and above them moonsails, are set in light winds.

Skysails,* next above the royals, are set and taken in, in the same manner as a flying royal. **Moonsails,*** next above skysails, are sometimes triangular sails, and generally only used at the

* Obsolete.

main; are set like the skysail, being hoisted up by the signal halliards.

To set a Head Sail. The manner of setting and taking in all the head-sails is the same. To set, give the order, *Clear away the jib!* (flying or jib-of-jib, as the case may be), *Man the halliards!* Have a hand by the downhaul to clear it away, and, in case of the fore-topmast staysail or jib, send a hand out to light up the hanks. When ready, *Let go the downhaul! Hoist away!* When up taut, trim the sheet.

To take it in. *Man the jib downhaul!* Have a hand to the halliards and sheets. When manned, *Mind your weather helm!* (if blowing fresh), *Let go the halliards!* HAUL DOWN! By easing off the sheets as the halliards are let go, the pressure of the hanks on the stay is relieved, and the sail comes down easily. *Lay out and stow the jib!* When stowed, take in the slack of the halliards and sheets.

The Spanker, an important sail, set abaft the mizzen mast, being at one extremity of the lever, governs the vessel more or less in all the evolutions. It serves to bring her to the wind, or to prevent her from falling off; is always set at sea, except with the wind aft or well on the quarter: and in coming to anchor, is the last sail taken in, as it is used to bring the vessel up head to wind, after the topsails are clewed up.

In setting the Spanker, top the boom up by both topping-lifts (if two are used), after which overhaul the lee one. *Man the spanker outhaul!* Have hands by the brails, and hands aloft to overhaul them. *Let go the brails!* HAUL OUT! Slack the weather vang, and trim the sheet.

To take it in. *Man the spanker brails!* Have the lee throat brail well manned, and hands to take in the slack of the weather one, and also the peak and foot brails; and a hand by the outhaul. *Let go the outhaul!* BRAIL UP! At the same time, haul the boom amidships and crotch it, or in wearing, haul it over on the weather quarter, ready for the other tack; steady the gaff by the weather vang.

Staysails.* Set between the fore and main masts, are the main topmast, middle, top-gallant, and royal staysails; the first is stowed, when not set, under the fore-top, and all the others in or above the fore-top. After being cleared away for setting, those in the top are triced up with their stays; after which they

* Staysails have not been used in the service for a number of years; but they have been revived in the merchant service, and it is not improbable that with our new vessels, they may be again introduced into the navy.

are set as the head-sails, the sheets leading down on deck, and belayed in the lee gangway.

These sails are only used in light weather, with the wind free. They are termed *lifting sails.*

Studding or Steering Sails, in light or moderate weather, with the wind free or aft, are used with great advantage, to increase the speed of a vessel. The weather topmast, top-gallant, and royal studding-sails, may be set with the wind one point free, or forming an angle of seven points with the keel. The lower studding-sail can only be used to advantage with the wind abaft the beam. With the wind aft and yards square, they are set on both sides, "alow and aloft." We will now set and take them in, commencing with the one generally set first.

The Top-gallant Studding-sail. At sea, this sail is kept in the top, stowed up and down in the topmast-rigging. To set it, order—

Stand by to set the top-gallant stun'-sails!

Haul taut the top-gallant lift. One of the quarter-watch repairs to the topsail-yard, where he converts the boom tricing-line into an "in-and-out jigger," and toggles the heel of the boom to a bull's-eye, which traverses on a jack-stay fitted for the purpose.

The sail is cast loose in the top, having only a ropeyarn stop around it. The halliards manned on deck, and the tack in the top, a hand by the sheet, and also on the yard to assist to rig out the boom.

Haul taut! RIG OUT! HOIST AWAY!

When the boom is sufficiently out (which will be known by the mark on it), the heel is secured, keeping it on the right slue for the tack. As the sail goes up, the topmen take in the slack of the tack. When it is above the topsail-yard, the stop cut, and tack hauled out, it is run up to the yard, and the sheet trimmed down.

To take it in. Order, *Stand by to take in the top-gallant stun-sails!* Man the sheet in the top, have a hand by the halliards, by the tack, and on the topsail-yard to rig in the boom; order *Lower away!* HAUL DOWN! RIG IN! Let the topmen roll the sail well abaft the top-gallant sail, easing off the tack before you lower the halliards, or it will fly forward of the top-gallant sail, and render the operation more difficult. When the sail is in, take the jiggers off the top-gallant lifts. The fore and main are set and taken in together.

MAKING AND TAKING IN SAIL.

It is a good plan to have a downhaul to a top-gallant studding-sail, bent to the inner end of the yard, and leading down into the top; by this it may be easily hauled down in taking in, and dipped forward when necessary.

The Royal Studding-sails* are set and taken in, in the same manner as the top-gallant.

The Topmast Studding-sail. To set it, order, *Stand by to set the topmast stun'-sail!* Get a burton on the topsail-yard and haul it well taut (the reef burton is usually taken for this purpose); get the sail out, and made up ready for sending aloft; overhaul down and bend on the halliards and tack; have one stop around the sail, and another around the halliards and outer yard-arm, to keep it up and down in hoisting; hook the in-and-out jigger on the lower yard for rigging out the boom. Having the gear manned—

Set taut! RIG OUT! HOIST AWAY!

As the sail passes the lower yard, the outer stop is cut, and when high enough above the yard to clear the brace, the other stop is cut. As it is run up to the topsail yard-arm, take in the slack of the tack and light the downhaul over the brace-block. Haul the tack close out, hoist the sail up taut, in the top trim the short sheet and dip the downhaul and deck sheet. As soon as the boom is out, its heel is lashed to the fore-yard, and the in-and-out jigger shifted for rigging in.

In-and-out Jigger. A gun-tackle purchase is used thus: To rig out, the outer tail-block is secured to the neck of the boom-iron, the inner one to the heel of the studding-sail boom; the fall is rove through a leading block, and then down on deck. In shifting it to rig in the boom, secure one of the tail-blocks to the slings of the yard, and the other to the heel of the boom, fall leading as before.

To take in the topmast studding sail. Order, *Man the topmast stun'-sail downhaul!* or, *Stand by to take in*, &c. Man the downhaul deck-sheet, in-and-out jigger; and have hands by the halliards, tack, and short sheet in the top.

LOWER AWAY, HAUL DOWN, RIG IN! Lower away the halliards, and haul the sail down to the boom by the downhaul; then let go the tack and haul down on the downhaul and sheet together, rigging in the boom at the same time. *Take the burton off the topsail yard!* Make up the sail, hitch the halliards to the clew of the topsail, and stop the tack along the boom.

* Obsolete.

MAKING AND TAKING IN SAIL.

The downhaul and sheets are made up with the sail.

A fore-topmast studding-sail is often carried when running before a fresh breeze, such as would reduce a ship to double-reefed topsails if close-hauled; in which case the boom should be well supported. In large vessels there is a brace to the boom, which is sufficient support; but in want of this, the lower studding-sail halliards may be used, thus: Toggle them above the boom, bring the standing part aft, and set it up securely abaft the fore rigging. This acts as a martingale or jumper to the boom.

A main-topmast studding-sail is carried, in some vessels, with the wind abaft the beam, and has great effect in increasing the speed. It is set and taken in like the fore.

In some vessels the topmast studding-sail tack is brought in along the yard, and the boom brace fitted with a short pendant and whip purchase, which is thought to be a proper method for a large vessel, having only the brace to attend to in trimming the yard; but if the brace and tack are rove through the sheaves of a double, or through two single tail-blocks in the main rigging, and both belayed together around the same pin, both may be attended to as conveniently as one.

To set a lower Studding-sail. Order, *Stand by to set the starboard* (or port) *lower stun'-sail!* Get it out and make it up for setting; overhaul down the outer and inner halliards, and bend them on, the former to the yard, and the latter to the inner headearing of the sail; overhaul in and bend on the outhaul to the clew; pass a stop around the sail, and secure it by a toggle, having a tripping-line (the whole called a squilgee) from it, leading in on deck. Haul well taut the fore-lift, brace, and trusses. Man the lower boom topping-lift, and forward guy, and have a hand by the after guy. Pull well up on the inner halliards. Top up the boom, and at the order, *Rig out!* haul forward on the forward guy, and at the same time having everything manned, halliards, outhaul, &c.—

Haul taut! HOIST AWAY, HAUL OUT! taking in the slack of the outhaul and inner halliards. When halfway up between the deck and lower yard, haul out the squilgee, and as the sail falls, haul out on the outhaul, and hoist it up taut to the topmast studding-sail boom; then haul out the outhaul and hoist up on the inner halliards. Reeve the sheet through a thimble or block on the goose-neck of the lower boom, and haul it well taut. The lower boom is trimmed by the foreyard, so that the sail may set, as nearly as possible, parallel with the foresail.

To take in, order, *Stand by to take in the lower stun'-sail!* Man the clew-line, sheets, and inner halliards, have hands by the outer

halliards and outhaul, *Ease away the outhaul!* CLEW UP! The outhaul being let go, the clew is hauled up to the yard; then, *Lower away, haul in!* Ease off the outer halliards, and haul in on the inner halliards, sheet, and clew-line. When the sail is inboard and over the forecastle, *Lower away the inner halliards!* The sail being down, make it up. Get the lower boom alongside, and trice up the gear.

The lower studding-sail is sometimes set in the following manner: A small tackle or jigger is hooked to a strap on the inner end of the studding-sail yard, and its double block in towards the slings of the fore-yard, the fall leading down on deck. Having the halliards and outhaul manned, run the sail up to the fore-yard by the jigger and inner halliards—keeping the clew-line hauled up close. Then haul out on the halliards and outhaul, easing out the jigger and letting go the clew-line as the sail goes bodily out.

And in taking it in, man the clew-line and jigger, clew up the sail and rouse it bodily in by the jigger and sheets, until inboard, and over the forecastle; then lower away the halliards and jigger.

This last method, though not in general practice, seems to be the neatest and most seamanlike, and it is the most expeditious for a large vessel.

The topmast and lower studding-sails, after being taken in and made up (furled), are wrapped in a tarpaulin cover, and stowed on each side of the launch, or on the boats amidships. In sloops-of-war, having a top-gallant forecastle, they are sometimes stowed thereon athwartships. The top-gallant and royal studding-sails are stowed in the tops, up and down the topmast rigging, at sea; and on the booms or in the sail-room, in port.

To set all the studding-sails on one side. Order—

Stand by to set all the starboard (or port) *stun'-sails!* Or—

Get the starboard (or port) *stun'-sails ready for setting!*

Preparations are made as described, with the addition of topping up the lower boom ready for rigging out. When the mate of the forecastle reports—

"All ready forward, sir!" order—

Set taut!

RIG OUT! SWAY TO HAND!

At this order the booms are rigged out together; the top-gallant studding-sails swayed aloft and landed on the straps of the topsail brace-blocks, the topmast studding-sail on the fore brace-

block, and the inner halliards of the lower studding-sail pulled well up. The men then shorten in on the halliards, when order—

Haul taut! HOIST AWAY!

When the tacks are hauled close out and the halliards taut up.

To take them in.

Stand by to take in all the starboard (or port) *stun'-sails!*

When all is reported ready—

Haul taut! Ease away the out-haul! CLEW UP! LOWER AWAY!

At this, the lower studding-sail is clewed up, the topmast studding-sail "boom ended," and the top-gallant studding-sail started, but their tacks kept fast.

HAUL DOWN! RIG IN!

When the sails and booms all come in together.

If studding-sails are to be set on both sides, at the same time, have all hands called to "make sail," and order, *Starboard watch, starboard side; Port watch, port side!* Then order, *Stand by to set stun'-sails both sides!* and proceed as in setting on one side, taking care that the yards are square, and the lifts, burtons, and braces, well taut.

Trysails are set and taken in like a spanker, the only difference being that the clew hauls aft by a sheet. They are constantly used on board steamers, but in sailing-vessels, seldom, except in gales of wind.

To set the Main Trysail. Command, *Clear away the main try-sail!* The sail is loosed, and the sheet taken aft and hooked The peak outhaul and sheet being manned, and a hand by the weather vang, *Clear away the down haul!* HAUL OUT! easing off the vang; when the outhaul is out, haul aft the sheet, and steady taut the vang.

To reef a Trysail. Get a burton on the throat and peak, lower away and reef, as in a spanker.

There are a few other sails, such as a *gaff-topsail* which sets over the spanker; a *ring-tail* which sets abaft the spanker; a *save-all*, under the lower studding-sail boom, and a *jib-topsail*, which sets flying over the jib. These are never met with in the service now, except the gaff-topsail, which is occasionally set on board the schooner-rigged gun-boats.

REMARKS ON MAKING AND TAKING IN SAIL.

Studding-sails. *In setting studding-sails*, after the lifts and burtons are up, and the leeches of topsails and top-gallant sails are steadied by the bowlines, trice the topmast and top-gallant studding-sails up high enough to lie over the brace blocks, and rig all the booms out at the same time; then man all the halliards and tacks, cut and slip the stops, and hoist away all together.

In setting studding-sails in a strong breeze, if you can keep the ship away until they are becalmed, you will get them up and well set when the gear would not otherwise stand.

Remember that with topmast and top-gallant studding-sails, the yards not only bear the weight of the sails, but also the downward drag which increases as the wind does, forcing the belly of the sails forward, and acting like a span: therefore, have the lifts and burtons *well* up before hoisting.

In bracing forward, studding-sail tacks, boom braces, and topping-lifts require careful attention.

In bracing in, unless the boom brace be manned, the chances will be in favor of the boom going anywhere but in a line with the yard.

In dipping the main topmast studding-sail before the sail, the wind will be just enough on the opposite quarter to glance off the topsail and blow the inner leech aft. If the course can be altered, the sail may readily be handled, otherwise the short way is to haul down, stop the bowline in on the main yard, and set the studding-sail before all.

It is of no manner of use to dip a lee fore-topmast studding-sail.

Preparatory to setting studding-sails, let the top-gallant clew-line be hauled taut, that the man who goes out on the topsail-yard may have something to hold on to; and in hoisting the *lower* studding-sail, be careful that the yard is not brought up with a *jerk* against the topmast studding-sail boom, as by the neglect of this point, the boom is often sprung. After the sail is set, the topping-lift should be slacked sufficiently to bring the outer leech taut.

In setting a lee top-gallant studding-sail forward of the sails, in lieu of stopping the halliards to the upper yard-arm (which is the *outer* one), bring them down to the lower yard-arm, so that in hoisting, the sails will capsize over, as it were, and bring the extremity, to which the halliards are stopped, uppermost. Sway higher, and let the man on the topsail yard (when high enough) cut the stop, and cant the yard forward, which, under these cir-

cumstances, may be readily done without getting foul. If the sail should be already set, and it is desirable to "dip" it forward, lower it about halfway down, ease off the tack, and let the man on the topsail-yard get hold of the *outer* leech. In this way the inner yard-arm is immediately canted clear of the top-gallant bowline-bridle.

Taking Topmast Studding-sails in. It is well to start the tacks a little, so as to settle the tack blocks to their work before hauling down. In hauling down, ease away the tack before the outer arm of the yard touches the boom end; and if the tack jambs, which is not unfrequent, rig in the boom at once. The leverage is great, and boom-irons are frequently broken in this way. With the lower studding-sails which have been carried with the yards much forward, get a good pull of the outhaul and after-guy before starting anything, else the lower boom will fly forward when the outhaul is let go.

Should the boom get under the bows, and the topmast studding-sail boom be in, put the lower halliards with a bowline knot round the lower boom, and haul them out with the lower outhaul; then, with these and the topping-lift from the fore yard, it may be got up. If not, secure the heel, disconnect the goose-neck, and whip the spar up heel foremost.

Of course, if the ship can be kept away, and the fore-yard braced in, all will be easier.

The operation of taking in a lower studding-sail may be greatly facilitated by giving the ship a sufficiency of *weather* helm to "touch" the inner leech. *Luffing* under such circumstances might be attended with loss of booms.

In taking in top-gallant studding sails, we find one authority saying, "always ease off the tack before starting the halliards, to spill the sail, when it may be hauled down by the sheet without difficulty." Another directs you to ease away on the halliards and haul down the downhaul, keeping fast the tack until the yard is well inside the leech of the top-gallant sail, when you may ease off the tack, and by hauling down on the sheet and downhaul, the sail comes in without difficulty. For should the tack be started first, the sail flies forward of the top-gallant sails and causes much trouble.

A third, and apparently the most preferable method, is to combine the two former, and having the sheet on deck, and *well manned*, ease away tack and halliards together, hauling down on the downhaul in the top.

In this, as in many similar cases, one or two trials during the practice cruise will doubtless settle the question, beyond all peradventure

venture in the mind of each individual midshipman; those stationed as top-men learning to their cost which is the worst plan.

Topsails, &c. In *loosing* a sail, whether it be blowing fresh or not, the *yard-arm* and outer gaskets should be cast off *first*, for otherwise the weight of the bunt would jamb them, and render cutting necessary to get them clear.

In taking in a topsail, the weather sheet is started first, to prevent the sail from flapping, of which there would be danger if it were taken in the opposite way. This rule applies equally to *courses*, as the belly of the sail thus blows up against the stays, and is prevented from splitting. Remember that the lee lower lift should be hauled well taut before starting the tack, lest the sudden upward spring of the weather yard-arm should endanger the lee leech of the topsail, and instead of *letting go*, *ease* the bowline off handsomely with the tack.

In setting either *courses* or *topsails*, in blowing weather, the rule seems to be invariable in reference to sheeting home to leeward first—the reason for which is to prevent the sails from flapping; and if the wind is quartering, the yard should be well braced in before the sails are set.

In *hoisting sails* from a royal to a close-reefed topsail, the *lee* brace ought invariably to be let go, and the weather one tended. As the latter is eased away, and the sail hoisted, the yard will cant of itself, till the leech is taut, which is the indication of the sail being up. If everything is clear, there will be no necessity for hauling in the lee brace while hoisting. In setting a *jib*, the sheet should not be kept taut, but eased, to let the sail go up; and observe, at the conclusion, that both the stay and the guys are taut.

In taking in the jib, if it be blowing fresh, the sheet should be slacked just enough to keep the hanks from binding against the stay, and to guard against the ship flying to, order—*Mind your weather helm!*

In taking in a *royal* or *top-gallant sail*, the lee sheet is started first and clewed up to spill the sail; for when blowing fresh, if the contrary practice was adopted the yard would probably fly fore-and-aft, part the brace and risk the mast, which is of far more consequence than the sail. The weather sheet must be eased off after the yard is clewed down, which can be done better by hauling in on the weather brace at the same time. Lay the yard and keep it lifting and rather aback with the helm until the gaskets are passed.

MAKING AND TAKING IN SAIL.

If before the wind, keep both sheets fast until the yard is down; then clew up and brace by. The same practice applies to royals.

The parrels of these yards are generally slack, and the yards should be bound, when possible against the rigging, by bracing in.

The late Captain Boyd, R. N., says: a royal carried too long before, and a top-gallant studding-sail carried too long near the wind, are the most difficult jobs that fall to a topman's lot to handle. Beyond a certain pace, these sails set as above, cannot do the least good. If the "trimmer"* is consulted while carrying a press of lofty sail before the wind, the ship will be found to be excessively out of trim by the head. Near the wind, the top-gallant studding-sail is fore-and-aft, bellying to leeward, and taking the wind out of the powerful forward pressing top-gallant sail.

Before the wind, studding-sails may be becalmed by a spoke of the helm, but the royal has no buntline; every bound of the sail shakes the top-gallant mast like a whip-stick, and the men cannot "handle" it. There is no proper alternative but to let fly the clew-lines, and let the sail blow to pieces. If the men have been allowed to go aloft to try and remedy the mischief, they won't come down, and cannot be made to hear until they have had a try. It becomes a point of honor with them not to give it up; and at last some bold fellow goes down the lift, and, if not jerked off, passes the gasket from the yard-arm in.

Then as to the studding-sail. It is easy for the officer to say, "*In royals and top-gallant stun'-sails!*" and to walk the deck as if he had done his share of the work; but ask the men, or take your place on the flying boom when the spar is pointing in the direction of the lee cat-head, and the sheets are banging like a volley of flails against it; or get up on the topsail-yard, when the studding-sail tack or halliards are let go (and you *must* let go one or the other), and the sail flies away to leeward before the top-gallant sail. Then the lee top-gallant sheet cannot stand it any longer, and cracks, and the top-gallant yard goes fore and aft, and the weather top-gallant lift has a jigger on it, and will not yield. So away goes the whole of it, and it is "nobody's" fault, because "the right order" was given.

Or else the weather top-gallant brace goes, and we have the same consequences. Or, all the gear holds on, and the sail, after an effort, wisps itself up round the topmast stay, whence it is

* See Theory of Stowage.

finally cut adrift; and the only consolation in the matter is the self-satisfied way with which the epitaph "lost overboard by accident" is written in the log, and the yards of "number seven" which the topmen contrive to save for other than public purposes.*

It would be easy to ascertain the rate of sailing in different ships beyond which small sails are unavailing, and thus to establish some general regulations about them.

It would be easy to confine the carrying of the lower studding-sail to a certain force and direction of wind insuring the benefits of a full foresail, and avoiding the trouble that occurs when the lower boom and sail go under the bows; for instance, when the jib is drawing, the lower studding-sail cannot be doing any good service.

We must again call attention to the use that may be made of the helm. When the men perceive that you understand how to throw a sail into their hands, with a turn of the wheel (either becalming it by bearing up, or spilling it by a careful luff), they will work with confidence and good will.†

* The difference, I observe, in the expense of sailing the ships is incredible. Some men who have the foresight to discern what our first difficulty will be, support and provide their ships by enchantment, one scarce knows how; while others, less provident, would exhaust a dockyard and still be in want.—*Collingwood's Letters.*

† Those midshipmen who make good topmen on board the practice ships will, when in charge of the deck, know what a quarter-watch is capable of, and will not be likely to get into such scrapes as detailed above.

CHAPTER XXIV.

WORKING TO WINDWARD.

STEERING—TACKING—MISSING STAYS—WEARING—BOX-HAULING—WEARING SHORT ROUND—CLUB-HAULING, ETC.

STEERING.

In general a ship, trimming by the *head*, requires a *taut* weather helm. If, on the contrary, she swims too much by the *stern*, she will carry what is technically termed a lee or *slack* helm.

When by the wind, a tremulous motion in the cloths of the *main-sail* will always indicate that the ship is then at the desired point of "full and by"—for when sailing thus obliquely to the breeze, the dog-vane does not show the true direction of the wind.*

When steering a course, much of the precision will depend upon the helmsman anticipating, or checking the ship in her inclination to yaw to starboard or to port; nor must he trust too much to the compass-card. Ordinarily, the compass suffers much agitation from the motion of the vessel, and does not return sufficiently quick to its parallelism to point out the *true* position of the ship's head; while on the other hand, the compass, in smooth water, must be touched to be set in motion. Good steerage, therefore, requires a quick sight and a nice judgment in the helmsman, and above all, an acquaintance with the *feel* and force of the helm. He must not pore over the compass, but alternately watch the card, and the motion of the vessel's head passing the clouds, the sea, or any other objects which may present themselves to view, more fixed than the compass itself. In blowing weather, the *feel* of the helm and the *force* of the wind are nice criterions to judge whether the vessel be falling off or coming to. As the vessel *comes to* against the helm, it will appear *heavier*, and the wind drawing forward will seem *stronger*. On the contrary, as she *goes off*, and gives way to the power of the helm,

* The apparent direction of the wind, shown by the dog-vane, is a mean between the velocity of the ship and that of the wind, since that direction partakes more of the greater than of the less. If the ship runs east with the wind at south, having one fourth the velocity of the wind, the vane will show about S. by E. ½ E. The angle between the real and apparent direction of the wind may sometimes amount to two points or more.

it *eases* in the hand, while at the same time the wind lessens in its force as it draws more abaft. To an attentive and nice observer, these circumstances, though seemingly trifling in themselves, indicate the motion of the vessel sooner than the compass. The stars or the breaking of the waves, at night, may also assist to prevent yawing the vessel about.

When *close-hauled*, the yards forward should be braced a little sharper than those aft, and the upper yards braced in a little more than those under them, especially with strong breezes. The leech of the *main-sail** is always best to steer by when blowing fresh; and when the wind is very light, the *main royal*. It frequently occurs with an old sea on, in light airs, that the sails all flap to the masts with every roll, and render it extremely difficult to tell when the ship is near the wind. If, under these circumstances, the officer of the deck will occasionally walk to the *lee* side, and cast his eye up on the fore part, or front of the light sails, he can more easily tell when the ship is near the wind, as the difference sometimes amounts to more than a point in the course which the ship might make.

Conning,† is the art of directing the helmsman to steer the ship on her proper course by compass or by the wind; the person who performs this duty is generally the quartermaster or pilot. The following are some of the terms used in conning ship: When steering by compass or landmarks, and it is desirable that the vessel's bows should go to the left, or to port, the order is given *Starboard!* Whereupon the helmsman turns the spokes of the wheel over to port, or in the same direction the ship's head is to go, and this according to the usual method of arranging the steering gear, has the effect of sending the tiller to starboard, and consequently of presenting the port side of the rudder to the action of the water.

* As the leech of the mainsail reaches farthest to windward, it will be the first to lift in coming to the wind.

† Modern invention is not behindhand in the matter of conning ship. By a contrivance of telegraphic wires, the officer of the deck, standing on the forward bridge, can silently communicate his orders to the man at the wheel, and receive a response with the utmost certainty and promptitude.

The words STARBOARD, PORT, and STEADY, are painted on glass, and so placed in a case by the binnacle that they may be illuminated at night, each word having in front of it a movable screen with a wire attachment. A similar arrangement is placed on the bridge. Now, when the officer of the deck touches a certain knob of his telegraph the desired word, STARBOARD for example, is unveiled at the other end of the line by the moving of its screen, and exposed to the view of the quartermaster at the wheel. On observing the signal, the quartermaster touches a corresponding knob, which has the effect of screening the word at his end and exposing to view the same word on the face of the plate on the bridge, thus replying that the signal was understood.

On board of our large screw-ships this system of telegraphing will be found of great utility.

STEERING.

Hard a-starboard! means to have the wheel over, so that the tiller will go to the extreme limit. When the vessel's head points in the right direction, the order is given, *Steady!* if slightly to the right of her course, needing to go very little to the left, the order is given, *Steady a-starboard*—that is, steady as she goes, but a little to starboard with the helm, if anything. In the same way to send the ship's head to starboard, they say, *Port, Hard a-port, Steady a-port.* The terms wheel and helm are used indiscriminately.

Meet her! When the ship's head flies to starboard or port in obedience to the helm, then, as she approaches her course the wheel is hove, spoke by spoke, the opposite way, to check her gradually that her head may not pass the desired point.

Should the ship be standing along on a taut bowline, and the quartermaster perceive a cloth or two of the main-topsail to be lifting, he cries out, *No higher!* by which he means that the ship is not only too high, or too near the wind, but that she should go off a little. Whereupon the helmsman gives her a spoke or so, of the weather wheel. On the contrary, should the quartermaster observe that the vessel was not quite near enough, he would say, *Nothing off!* meaning to let her come to the wind, when the helmsman would ease the wheel and permit her to come up. When the ship is "a good full and by," he says, *Very well thus!* or, as it is commonly pronounced, *Very well dice!* Formerly they also said, *Dice no higher! Dice nothing off!* which has been contracted to the above, omitting "thus." Again he orders, *Luff! Let her luff!* when the helmsman eases the wheel and lets her come up into the wind; if she does not come up enough the order is given, *Hard down!* To prevent her from going around on the other tack, the quartermaster exclaims, *No higher!* and to resume her former course, *Keep her a good full and by!*

To keep the ship away, the order is, *Let her go off!* which may be followed by, *Hard up!* when off nearly enough, *Meet her!* and when heading the right way, *Steady so!* To haul her up again, *Let her come to! Bring her by the wind! Keep her full and by!* When any of these orders are given when sailing by the wind, or steering a course, you may see a bad helmsman heave his wheel over inconsiderately, giving the ship a rank sheer. This should be corrected by ordering him to give her a *small helm.* There are other expressions, such as, *Nothing to starboard* or port. "*Nothing to the N'd, &c., of your course.*" *Mind your weather wheel! Keep her a clean full! right the helm,* or put it amidships; *Shift the helm,* or change it from one side to the other, &c. When sailing with the wind aft, the terms starboard and port are used, and the same should be observed with the wind quartering to prevent mistakes.

TACKING.

As a general rule, in the service, and on board the practice ships, when the helm is a-starboard, the turns of the starboard wheel rope will be found to have accumulated around the forward half of the barrel of the wheel—for a port helm the turns will be found aft. A midship helm is indicated by the midship spoke of the wheel which is made differently from the rest that it may be detected at night by the touch.

In contriving any new steering gear it is quite an important item that the working of the wheel does not differ from that to which seamen are accustomed; that is, *to heave the wheel in the direction the ship's head is to go*—otherwise, at some critical juncture, confusion may ensue, and probably serious disaster.

It was remarked, under the head of sails, that the perfection of equipping a ship with spars, rigging and sails, consisted in so disposing them that the efforts of the forward and after sails to turn the ship will be so exactly balanced as not to require any continued assistance from the helm in either direction. Of the two evils, however, seamen have more patience with a ship disposed to approach the wind than with one needing the continued action of the helm to keep her from falling off. The French helmsmen well characterize these two qualities, by calling a vessel which has the first, *ardent*, the latter, *cowardly*. Like cool courage, however, between impetuosity and timidity, a midship helm is still the golden mean, though tending, as it should, towards the former.

In turning to windward, if the ship be in trim, her weights well disposed, her sails not only well set but judiciously balanced, as just described, there will be a lively strain on the weather wheel ropes, yielding to the influence of a single spoke. Her head will rise and fall in easy, graceful undulations; there will be a tremulous motion in the tiller, a sensible pulsation which is said to be an infallible sign of good trim, denoting the amount of life and energy in the whole thing. Like a well-mouthed pulling horse, if the wheel be let go at the moment when the pull is strongest, she will dart ardently into the wind, and go round of her own accord.

Take her, then, at one of these moments, haul the spanker boom over gradually, ease off the head sheets, and you may steer her round, from tack to tack with the utmost facility.

TACKING.

When a vessel is headed off from her course, the yards are braced up sharp, sheets trimmed aft, and by keeping her as near as possible to the wind, with the sails all full or drawing, she is

TACKING.

then "*close-hauled ;*" and the tack she is on is designated by the side of the vessel on which the wind blows ; for instance—if the yards are braced up by the port braces, having the wind forward of the starboard beam, she is then "*close-hauled on the starboard tack*," or "*has her starboard tacks aboard.*"

Your port of destination, or the point for which you wish to steer, being in the direction from which the wind blows, the nearest you can steer to that course, is when the vessel is close-hauled. In which case she will, if a square-rigged vessel, lie within from five and a half to six points of the wind (some vessels working nearer to the wind than others). And if, after standing on one tack a certain length of time, you "*go about*," and stand on the other, and so on, you are approaching the object continually, in the proportion of about one third of the distance sailed. This is termed "*working*," "*beating*," or "*turning to windward.*"

Tacking is the most usual method of going from one tack to the other, in moderate weather and with a good working breeze. It has this advantage over all others, that you lose nothing to leeward when it is properly performed ; for vessels will frequently, if well managed, luff up head to wind, and go about, without for a moment losing their headway, but, on the contrary, gain several times their length directly to windward, while in stays.

Considerable judgment must be exercised, and attention paid, in performing this evolution properly. The qualities of the vessel are to be considered, some working quicker and some slower than others ; some come rapidly up head to wind, and then fall off on the same tack ; some require the head sheets to be well over-hauled when the helm is put a-lee, others tack by keeping them fast ; some will go around until the after-sails take on the other tack, and in bracing round the head yards, will luff up again into the wind, gather sternboard, and lose ground in stays, before they can be recovered on either tack ; therefore care must be taken to perform this evolution to suit the qualities of the vessel, with which an officer will become acquainted in working her.

In working to windward, the wind frequently "*veers and hauls*" three or four points, heading the vessel off or allowing her to come up ; this is particularly the case in the vicinity of land. The proper moment to tack in such cases, is when the wind is heading her off, for on the other tack you will evidently gain more to windward. By watching attentively, and taking advantage of such slants of wind, keeping the vessel "*a good full*," and by the wind, you will gain much more on your course, than if you stood a certain number of miles or hours on each tack, let the wind veer and haul as it may.

TACKING.

We will now proceed to "*tack ship*" under courses, topsails, top-gallant sails, jib, and spanker; giving as nearly as possible the treatment for different vessels, and the necessary orders.

Ready about!

Keep her a good full for stays, see the men at their stations, viz.: a hand by the jib-sheet, hands by all the bowlines, lifts, trusses, tacks, and sheets; hands in the chains to overhaul the lee main sheet; the clew-garnets manned; topmen at the breast back-stays, and a few aloft to overhaul the lifts and trusses, and to attend to the out-riggers; a good helmsman at the wheel; a quartermaster at the conn; a few hands at the spanker sheet and lee topping-lift, and all the rest of the force at the weather main and lee cross-jack braces, lee main tack and weather main sheet. The men being at their stations, proceed as follows:

Ready! Ready! Ease down the helm!

Haul the spanker boom amidships—and the helm being down, order—

HELM'S A-LEE! Ease off the fore and jib-sheets.

*Overhaul the lifts and trusses!** or, with patent trusses, *Overhaul the weather lifts!* The lifts and trusses are let go and overhauled. She is now coming up rapidly to the wind, and as soon as the sails shake, the wind being out of the lee clew of the main-sail—

RISE TACKS AND SHEETS!

The fore and main tacks and sheets are let go and the clews of the sails hauled up by the clew-garnets, high enough to clear the hammock rails; at the same time, *Shorten in the main lee tack!* and weather sheet. Haul taut the lee spanker boom topping-lift, and overhaul the weather one;† and as soon as the wind is directly ahead, or a little on the weather bow—

Haul taut! MAIN-SAIL HAUL!

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* When rope trusses and breast back-stays were in use, the order in regard to them in working ship was, *Let go and overhaul the lifts and trusses! Bear off the weather backstays!* Breast back-stays are no longer used, and as trusses are, with few exceptions, made of iron, the orders relating to them have for the most part been omitted. When the old-fashioned truss is used, the order relating to it can always be introduced with that for the lifts, as above. The weather truss and brace should be hauled taut together, and when before the wind, the yard must be well trussed to. To "truss to" the cross-jack yard, the braces must be slacked.

The royal shrouds set up in the top, and are worked very much as breast back-stays; it is therefore well to see that the weather ones are set up, in stays.

† Not applicable to the practice ships, or ships having but one topping-lift.

TACKING.

The lee braces* and the bowlines are let go, and the yards swung around briskly by the weather braces; hauling aboard the main tack, and hauling aft the sheet. To hasten the operation, the order is sometimes given, *Haul forward the lee main tack and main to' bo'line!* Brace the yards sharp up, trim them by the wind, and haul taut the weather braces, lifts, and trusses; she has now the sails on the foremast aback; which, with the jib, are paying her off rapidly.

Man the head braces!

Man also the fore tack, sheet, and head bowlines; and as soon as the after sails take, or are full—

Haul well taut! LET GO AND HAUL! To the quartermaster, *Right the helm!* Brace around the head yards briskly; boarding the fore tack and hauling aft the sheet, as the yards are swung. And as with the main the order is frequently given, *Haul forward the fore tack and head bo'lines!* Brace up sharp, trim the yards, haul taut the weather lift and braces.

Haul taut the lifts and trusses! Steady out the bo'lines! The lower lifts, braces, and trusses, are hauled taut, and the weather leeches of the sails hauled out by the bowlines. Keep her by the wind.

When you swing the after yards, the wind being ahead, shift over the jib sheet, when it will take the right way, and trim aft.

Having the vessel a good full for stays, and particularly with a light breeze, or if she carries a weather helm, it is best to *ease* the helm down, and let her come up gradually into the wind; hauling aft the spanker sheet as the sail lifts.

In vessels which are dull in stays and go off slowly after coming up head to wind, and particularly in a light breeze, it is advisable to keep the fore tack fast, to pay her off, when you rise the main tack; in which case the order will be, *Rise main tack and sheet!*

In determining the moment to swing the after yards, you must be governed by the strength of the wind, and the qualities of the vessel. The general rule, and a safe one, is to do so when the wind is directly ahead. But with a good working breeze, and the vessel coming up briskly, it is best to haul them when the wind is about one point on the bow, before coming head to wind; for then the wind on the weather leeches of the sails forces them

* If using forward main braces for working ship, check a little of the lee fore brace, before hauling the main yard, to prevent the lee forward brace from fouling the fore yard.

around smartly, and affords you time to brace up, trim the yards, and get the tack down, before it becomes necessary to swing the head yards.

When the after yards take, and while bracing around the head yards, vessels frequently are falling off so rapidly, that before they can gather headway, they bring the wind abeam, and sometimes abaft. In which case, as soon as the head yards take—

Avast bracing! Flow the head sheets! putting the helm a-lee, if her headway continues.

As she comes up to the wind, *Brace up! Gather aft!* Brace up sharp, trim aft the head sheets, and meet her with the helm.

Some vessels, particularly those that carry a weather helm, requiring very little after sail when close-hauled with a stiff breeze, will not fall off after the after-yards take, and frequently will fly up into the wind while you are bracing around the head-yards; in which case, be careful not to brace round the head yards, until she is well around; and if she flies up into the wind, let go the main sheet, and, if necessary, brail up the spanker, and haul in the lee crossjack braces.

When the mainsail is not set, to haul the after yards, order—

MAIN-TOPSAIL HAUL!

Should you haul the head yards too soon, the ship may come to again, in which case, if the above method fails, *Rise fore tack and sheet, clear away the head bo'lines! brace abox the head yards!* and box her off again.

In hauling aboard the main tack, it is necessary, from the manner in which the lee main brace leads, to ease it off, as well as the weather main lift. When the tack is close down, brace up the yard, haul taut the weather brace, lift and truss, haul the bowline, and trim aft the sheet until it is *shrouded.*

When the helm is put a-lee for stays, it should be kept so until she loses entirely her headway; then, *Right the helm!* and if she gathers sternboard, *Shift the helm!*

If you perceive that the vessel comes up to the wind slowly, and you have any doubt of her staying, haul down the jib, haul the spanker boom well over to the windward, overhaul well the fore-sheet, and as you rise tacks and sheets, check the lee fore-topsail brace, observing to brace it up again as soon as it is aback, and to hoist the jib or haul aft the sheet, as soon as it will take the right way. This will in most cases insure the evolution, though it tends to deaden the "*head reach*," and should not be otherwise resorted to, except in working to windward in a narrow channel; when, having stood boldly on to either shore, particularly the

weather one, you are fearful of head reaching too much in stays.

TO TRIM YARDS.

When close hauled. First, brace the lower yards up sharp, belay the lee braces, and haul taut the weather one; then trim the topsail yard, if for a stiff breeze, with the weather yard arm about a half point abaft the lower yard, and the top-gallant trimmed by the topsail yard in the same way, and so on.*

In a light breeze with a smooth sea, when it is desirable to gain as much to windward as possible, the upper yards may be braced *over* the lower, and all got as nearly fore and aft as they will go, and always, except in very heavy weather, the sails should be taut up, and sheets close home or flat aft.

In a strong breeze accompanied by a "topping sea," it is sometimes desirable to keep in a little of the weather braces, in order to lessen the lateral impulse of the vessel. But in smooth water, with a steady commanding top-gallant breeze, the yards of *no ship can be braced up too sharp.*

When the wind is abeam, if the yards be so braced that the angles between them and the wind may be a point and three quarters *greater* than the angles formed by the yards and the line of the keel, that point will produce the greatest headway.

As the dog-vane is deceptive, the practical way to ascertain if the yards are laid well, is to luff the ship to by the compass a point, a point and a half, or two points, as the case may be, when if the yards are properly braced the sails will shake, thus giving the number of points free. The same may be ascertained by bracing to the mizzen topsail.

It is necessary that all sails should be trimmed to stand as taut as possible. The more a sail is made to approach to a flat surface, either by or before the wind, the better. (See SAILS.) The idea that there should be a reef of slack canvas (flowing, bag, or monkey-reef) let out when sailing large (except in the event of scudding, where it is sometimes desirable to make a *lifting* sail) has long since exploded.

* The upper yards should be braced in more than the lower; first, because the larger sail having greater curvature than the smaller must have its yard braced up to a sharper angle, that the plane of both may have the same angle with the keel; second, because the upper portion of the sail being attached to the yard approaches nearer to a plane than the lower part which bellies out, hence the upper part need not be so sharp, and thirdly, the lighter yards and braces require a greater angle for their support. Further, the upper yards being in, when the main royal is just lifting, all the other sails are a "clean full and by," which makes it such a good sail to steer by.

TRIMMING YARDS.

If the wind is abaft the beam, the after yards should be braced sharper than the head yards, that the wind may fill the forward sails:

Theory gives the following angles as the most advantageous for bracing yards:

APPARENT ANGLE OF WIND AND COURSE.	ANGLE OF SAILS AND KEEL.	ANGLE OF SAILS AND WIND.
	°	°
By the wind, or 5 points	20	36.08
" " " 5½ "	22.30	39.40
" " " 6 "	25	43.00
1 point free, " 7 "	30	49.06
Wind abeam, " 8 "	35	54.28
1 point abaft, " 9 "	40	59.13

Don Juan d'Ulloa, who was eminently practical, as well as scientific, experimented with a sixty-gun ship, close hauled under all sail (in those days, 1770, six points from the wind). He found the angle the yard should make with the keel to be 28°. With the wind on the quarter 50°. When the wind was so high that only a small quantity of canvas could be set, these angles were respectively increased to 40° and 56°. This does not differ materially from those given above. He also arrived at the general conclusions that the greater the quantity of sail set or the more adapted for velocity the vessel is, or the nearer the sails approach plane surfaces, the less should be the angle formed by the yard and the keel.

Fincham gives 19° as the angle the main yard should form with the keel, when closehauled. This too agrees with the above table, and to practice also; for many of our ships easily work within ten points.

We find theorists saying that the wind in passing from the sails on the foremast becomes more fore and aft, when it strikes the mainsail, and that therefore the after yards should be braced sharper than those forward. But in practice it is much better to keep the fore yard sharper, so that in "luffing to," a cloth or two of the main topsail will be lifting when the weather leach of the fore-topsail is just trembling. By this means a ship is more readily kept away again. Were the suggestions of theory adopted in this case the fore topsail might catch aback, while shivering the main, and pay the ship off on the other tack.

MISSING STAYS.

Rules for bracing yards are at best but general guides to practice, and the ready skill of the seaman will have to be constantly relied on in the minor details of trimming yards and sheets, in order to get all the speed out of a ship. Probably the best school for this, as well as for many other points in practical seamanship, is in squadron sailing.

TO HAUL OF ALL.

The evolution of tacking may be performed in a smart working vessel, and a light breeze, by swinging all the yards together. The crew must be properly divided at all the braces, weather-head and main, and lee crossjack. Then let her come up head to wind, and fall off on the other tack, shifting the helm if she gathers sternboard, until she brings the wind about five points on the other bow. Then give the order, *Haul well taut!* HAUL OF ALL! swinging around all the yards briskly. *Right the helm!* Board the fore and main tacks, and haul aft the sheets. Trim the yards and haul the bowlines. This is not a necessary operation, and only done to try the activity or force of a crew, and the qualities of the vessel.

MISSING STAYS.

In performing the common evolution of tacking, vessels often miss stays, either because of the dullness of the ship, the want of judgment in the officer, the wind hauling while in stays, or more commonly (for the best seamen with the smartest vessels sometimes fail), owing to negligence or inattention.

A vessel will sometimes come up until the wind is ahead, and, although the after yards are swung properly, lie in that position dead in the water (*in irons*, as it is termed), and eventually fall off the wrong way; or the officer may have swung the after yards too soon; or it may be owing to other causes. If she gathers sternboard, she may be made to fall off the right way by shifting the helm; but should this be insufficient, haul up the mainsail and spanker, put the helm a-lee, square the after yards, and brace abox the head yards. As she falls off on the same tack, brace up the after yards, and when they take, *Let go and haul!* as in tacking. Board the fore tack, set the mainsail and spanker, and when she gathers headway, try her again; or you may wear her round on her heel, or by the following method, which is probably better: Having hauled the main yard—

Flatten in forward! and ease off the spanker sheet. Lay the after yards square, keeping the helm a-lee, for sternboard; as she goes off, brace up the after yards, trim the sheets and stand on for another trial.

TO TACK WITH A DRAG.

Should she not go off by this arrangement of sail, then—

Rise fore tack and sheet! Clear away the head-bo'lines! Brace around the head yards! bracing up the after yards on the old tack. By this disposition of canvas, the helm being still a-lee, she must pay off. When full aft, *Head braces! Haul well taut!* LET GO AND HAUL! and brace around the head yards and stand on. Or the ship may be *boxed* around on the other tack.

But if she should come to a stand, and fall off before the after yards are swung, it is only necessary to *Flatten in the head sheets!* ease off the spanker sheet, or brail it up; and board the fore and main tacks. Trim the jib and spanker sheets as she fills, and after getting sufficient headway on, either make a second attempt or wear her. Though the head sheets may be *aft* they can be *flattened in* by hauling them over amidships, and when no longer wanted so, give the order, *Draw the head sheets!* when they will be restored to their proper trim.

TO TACK SHIP UNDER DOUBLE-REEFED TOPSAILS.

Call all hands about ship, watch for a smooth time and ease down the helm; haul down the jib, and aft the spanker sheet as she comes to. HELM'S A-LEE! Ease off the fore sheet, keeping fast the tack to assist her around against the sea. When the wind is out of the mainsail, RISE MAIN TACK AND SHEET! *Let go and overhaul the weather-lifts!* When the wind is nearly ahead, *Haul taut!* MAINSAIL HAUL! brace sharp up the after yards; get the main tack down and the sheet aft, hauling the bowlines; shift over the jib sheet and hoist away the jib as soon as it will take, and bear over the spanker boom. When she gets sternboard, shift the helm; RISE FORE TACK AND SHEET! and when the after sails fill, *Haul well taut!* LET GO AND HAUL! Haul forward the fore tack and head-bowlines. Should she fall off rapidly, *Avast bracing!* As she comes to, meet her with the helm. BRACE UP! GATHER AFT! Trim the yards; haul well taut the weather-braces, lifts, and rolling tackles, and steady out the bowlines, clear up the decks and pipe down.

The head yards should not be braced in, that the ship's headway may be preserved, that method answering only for a light breeze and smooth sea.

TO TACK SHIP, USING A DRAG,

When near the land in a light breeze. Secure a single block of suitable size to the jib-boom end and reeve a small towline through it, bringing one end aft to the weather-quarter, outside of everything, and bend it to the drag, which may be triced up

CLUB-HAULING.

to the weather main brace bumpkin. Have a hundred fathoms or so of the line ready for running out, and when all is prepared, *Ease down the helm! Let go the drag!* Luff around as in tacking, and having the towline well manned, when nearly head to wind, *Haul taut!* MAINSAIL HAUL! WALK AWAY WITH THE SPRING! The drag being now well on the weather quarter, the spring will easily carry the ship's head past the direction of the wind. When the after sails fill, *Let go and haul*, &c. Walk the drag up to the jib-boom end, get it inboard and ready for use again.

For experiments on board the practice ships, halliard-racks, lined with canvas, have been found to answer. On a lee shore, in very deep water, a sea-anchor might be used in the same way, which would be less expensive than *club-hauling*, by letting go a bower. Or an old boat, with a hole stove in its bottom, might answer, in which case the hawser would have to be cut as soon as the ship got around.

CLAWING OFF A LEE SHORE.

In clawing off a lee shore, all the sail possible must be carried. If blowing hard in squalls, the ship must be *luffed through* them. If blowing *very* hard, the topsails should be furled, and whole or reefed courses kept on her as long as possible, as she will hold a better wind.

CLUB-HAULING.

In working off a lee shore, against a fresh breeze and head sea, when you cannot risk missing stays, and have not room to wear, you must then resort to this evolution.

Get the lee anchor off the bows, and ready for letting go; the cable ranged, bitted, and well stoppered; bend a hawser to the ring of the anchor, and lead it in at the lee quarter; have hands stationed at the anchor ready for letting go; the hawser led along the deck, a carpenter, with an axe, ready to cut away the cable, if a hempen one, or the armorer, to unshackle, if a chain.

Station the men for stays, and proceed as in tacking, until she will come up to the wind no further; and the moment she loses her headway, let go the anchor, and brace around the after yards. As the anchor fetches her up, she will swing head to wind, bringing the head sails aback. *Man the hawser and head braces! Veer away the cable!* and spring around her stern by the hawser. As soon as the after sails take, *Cut away the hawser!* LET GO AND HAUL! swinging around the head yards. Bring her by the wind and right the helm; trim the yards and haul the bowlines.

You have expended, by this evolution, an anchor, part of a cable, and hawser; but if resorted to with judgment, in an extreme case, you may have saved by it your vessel.

The advantage of letting go the lee anchor, in preference to the weather one, is, that when it fetches her up, it will bring the wind a little on the bow from which the cable leads, and in casting, as you cut the cable, it will run out clear of the stem.

A ship may perhaps be placed in the same situation as to the land, with the wind moderate, and the swell sufficient to make it doubtful whether she will tack or not; in such a situation a kedge might be sufficient to insure the tacking of the ship.

Club-hauling Steamers. Club-hauling, on many occasions, might be made most useful to steamers, when required to turn in a narrow channel, or in blowing weather on a lee shore, and owing to their great length, cannot otherwise be brought round. In such a case, when the steamer comes head to wind, her anchor might be saved, with care and attention, as she would then have her full propelling power in the right direction, namely, head to wind and right off from danger.

To work to Windward with a Prize in tow. The towing hawser is secured to the bitts or mainmast and lashed amidships on the taffrail, having plenty of parcelling in the wake of all chafes. When ready for stays, direct the tow to put her helm up and veer under your lee; at the same time put your helm down, which being assisted by the towline of the lee quarter, will bring the ship's head to the wind; as soon as you have gathered headway on the other tack, the towrope will, in time, bring the prize around; if the masts are standing, let her swing the yards at the proper time, and she will be directly in your wake.

WEARING.

Wearing or veering is another method of going about from one tack to the other. This is only resorted to in heavy weather, with a sea on the weather bow; when under easy sail, or in light airs; when, in either case, the vessel has not sufficient headway for tacking. It is exactly the reverse of tacking, though tending to the same purpose, for you run the vessel off from her course, or the wind, until she comes around again on the other tack, having performed a sweep of the whole horizon, less that part of it which subtends the angles formed by a six-point course on either tack; in doing which, she must lose considerably to leeward; therefore the evolution should be performed in such a manner that the loss may be as little as possible.

WEARING.

To wear Ship in a light Breeze, under courses, topsails, topgallant sails, jib, and spanker, give the order—

*Stations for wearing! or Stand by to wear ship!**

Station the men as in tacking.

Man the main clew-garnets and buntlines! Spanker brails! Weather main and lee crossjack braces!

The men being at their stations as directed, order, *Haul taut!* UP MAINSAIL AND SPANKER! *Put the helm up! Clear away the bo'lines!* and as she falls off, BRACE IN THE AFTER YARDS! Keep the mizzen topsail lifting, and the main topsail full, the former to present no opposition to her falling off briskly, and the latter to keep up her headway, without which wearing is, in a very light breeze, a tedious operation—*Overhaul the weather lifts!*

She falls off, bringing the wind abaft the beam, and you have braced in the main yard until it is square; continue bracing the crossjack yard, to keep the sail lifting, until it is braced up sharp on the other tack.

She continues falling off, and you have now the wind directly aft. *Man the weather head braces! Rise fore tack and sheet, clear away the head bo'lines, lay the head yards square! Shift over the head sheets!*

She has now the wind on the other quarter. Haul out the spanker, and brace up sharp the after yards. *Man the main tack and sheet!* and when manned, *Clear away the rigging, haul aboard!*

The after yards being braced sharp up, with the mainsail and spanker, bring her to the wind. The head yards being square, and the jib-sheet flowing, present no opposition to her coming to. As she comes up, brace up the head yards, keeping the sails full, board the fore tack, haul aft the sheet, and meet her, as she comes to, with the jib and helm. When by the wind, right the helm, trim the yards, *Haul taut the lifts, trusses and weather braces! Haul the bowlines!*

Second Method. In a fresh breeze, or even in a moderate one, vessels under easy sail, "*Standing off-and-on*" a port, with not sufficient sail set for tacking, will wear. The only difference in the evolution is, that you may, with a good breeze, having headway on that keeps her under the complete management of the helm, keep the main topsail, as well as the mizzen, lifting as she goes off, which hastens the movement; and *bracing the after yards sharp up on the other tack, before you touch the head yards.* When before the wind, brace the head yards square, and brace them up as she comes to. All other parts of the evolution being similar to the preceding.

* The order *Ready about*, is sometimes, though improperly, given.

WEARING.

TO WEAR IN A GALE UNDER A CLOSE REEFED MAIN TOPSAIL, FORE, MAIN, AND MIZZEN STORM STAYSAILS.

Call all hands to wear ship! Clap a stout lashing around the bunt of the foresail and yard, and have a hand in the slings in readiness to overhaul the rigging. Hook the weather storm staysail sheets, stretch along the fore tack—*Man the main and mizzen staysail downhauls!* and have hands by the halliards and sheets. *Man the weather main, and lee crossjack braces!*

In a gale, with a heavy sea, vessels lying to will come up and fall off four or five points. Watch for a smooth time, and when she is falling off put the helm up—*Haul down the mizzen staysail!* bracing in the after yards as she falls off, keeping the main topsail full, and the crossjack yard pointed to the wind. Attend the lifts and trusses, as in wearing under all sail. As the wind draws aft, ease off the main staysail sheet; and when of no further use in forcing her around, haul it down, shift over the sail, and gather aft the sheet.

If the vessel in this situation will go off no further, as is sometimes the case, man the weather fore tack, overhaul the gear, ease down the clew-garnet, and haul aboard the weather clew of the foresail; which will increase her headway, and with her helm still a-weather, will serve to pay her off. A foresail in this state is "*goose-winged.*"

When before the wind, haul up the foresail, *Right the helm!* and square the yards fore and aft. Take in the slack of the fore staysail sheet. *Man the main and mizzen staysail halliards and the main braces!*

Watch for a smooth time, then ease down the helm, bracing up the after yards; *Hoist the main and mizzen staysails!* and brace up the head yards as she comes to; haul taut the lifts, trusses, weather braces, and main top-bowline. Hook and haul taut the rolling tackles.

As soon as the staysails are hauled down, shift them over to the other side of the deck, and take in the slack of the sheets to be in readiness for hoisting.

To wear under bare poles. Man the weather fore rigging, or place tarpaulins outside the weather fore shrouds, put the helm a-weather and work the yards as usual. Should there be any doubt of the ship wearing under the circumstances, take the precaution to send down the yards on the mizzen, also the mizzen topmast and top-gallant masts; get a span on the mizzen mast, bend a hawser to it and securely belay the end inboard. Now, if she does not pay off, cut away the mizzen mast as a last resort, veer away the hawser and use it as a drag.

WEARING.

Box-hauling is a fourth method of putting a vessel on the other tack. This evolution may be performed in working out of a narrow passage; when, having approached the weather shore so near as to have no room for head-reaching, you are not willing to lose ground by the ordinary method of wearing.

Ready about! Station the men as for stays. *Man the main clew-garnets and buntlines, and spanker brails! Put the helm down! Light up the head sheets, and check the lee head braces!* to deaden her headway. As the sails lift, *Rise tacks and sheets! Up mainsail and spanker!* Man the weather head, and main and lee crossjack braces.

She comes head to wind, and as soon as she loses her headway, *Clear away all the bo'lines! Haul taut! Square away the after yards! Brace abox the head yards! Haul flat aft the head sheets!* The helm is right for sternboard, she is going rapidly astern, and at the same time falling off, forming with her keel the segment of a circle, or "*wearing short round on her heel.*"

As the after sails lift, brace them in to keep them lifting, until they are braced up sharp on the other tack; and brace square the head yards. As soon as the sails on the foremast give her headway, *Shift the helm!* The spanker boom having been shifted over on the other quarter, *Spanker outhaul! Main tack and sheet!* When the wind is aft, shift over the head sheets, and as soon as the spanker will take, *Haul out the spanker! Clear away the rigging!* HAUL ABOARD! Board the main tack and haul aft the sheet.

The after yards, being braced sharp up, with the spanker, head yards square, jib in the brails, or the sheet flowing, and helm alee, she will come to the wind rapidly. Brace up the head yards as she comes to, and meet her with the helm and jib; trim the yards and haul the bowlines. If to gain to windward in this evolution, use the helm and head sheets as in tacking; but if to avoid danger, jamb the helm hard down at once, flow the head and fore sheets and then proceed to back her around.

TO WEAR SHORT ROUND.

Some officers make a distinction between box-hauling and wearing short round, as follows, being a fifth method.

In any sudden emergency, haul up the mainsail and spanker, man the braces as above, and, without going into the preliminary of luffing up into the wind, as in box-hauling, put the helm hard up, square the after yards, and brace abox the head yards. The

HALF-BOARDS.

moment she loses her headway, shift the helm for sternboard. After which, proceed as in box-hauling.

There is a decided difference in the commencement of the evolutions. Either of them may be termed box-hauling—a term derived from the circumstance of bracing the head yards abox—and both have the effect of wearing the vessel short round. By the former, you lose less ground than by the latter, for a vessel, with good headway on, will range ahead some distance after the sails are all thrown flat aback.

HALF-BOARDS.

Beating up a river with a strong windward tide, schooners or boats may be luffed up into the wind with everything shaking, and then, as they begin to lose their way, permitted to fall off on the same track, the tide in the meantime sweeping them up the stream very considerably. They may be thus enabled to weather a point of land, a vessel at anchor, or other obstacle, when otherwise they would have been compelled to make a board or two to clear it.

In a tideway the half-board is of great use, though it may be practised by ships at sea, sometimes, with great advantage. Thus, READY ABOUT! *Stations for stays! Put the helm down! Flow the head sheets!* The ship now "flies to" (for it can only be practised in a good working breeze), with everything shaking; when she has shot up into the wind a good distance, and commences to lose her way—*No higher! Flatten in forward!* and let her go off to a *good full and by* again.

When a ship is *box-hauled*, she may be said to make two half-boards; first, when she is *luffed up* into the wind, and again, when she is *backed up* into the wind stern foremost, by which she rather gains to windward.

To back a Ship around off a Lee Shore, Fig. 396, Plate 77. This evolution can be practised to very great advantage in moderate weather, and is particularly applicable when, beating in a river or channel, the ship misses stays and you have no room to wear. It may be remarked here, that this, as well as all other evolutions requiring the ship to be *backed astern*, should be adopted in moderate weather only, as there is danger, in a very fresh breeze and a rough sea, of injuring the pintles and gudgeons of the rudder, straining the rudder-head, &c., &c. Having stood well over on one shore (position No. 2, Fig. 396), *Ready about!* Luff to, rise tacks and sheets, and when you judge proper, *Mainsail haul!* If she continues to go around, proceed as in tacking of course; but should she come to a stand still, and refuse stays,

REMARKS ON TACKING

Brail up the spanker! Man the head braces! and *Let go and haul!* as usual. You have now the wind about a point on the weather bow, everything braced sharp aback and the helm a-lee (No. 3). With this arrangement of canvas she will soon gather sternboard and pay off rapidly at the same time, bringing the wind abeam, with everything hard aback, thus *sailing astern.* But the helm and the head sails cause her stern to luff into the wind, and the after leeches of the topsails will soon commence lifting.* The wind now gets aft, and the sternway, which has been decreasing, will cease, when the helm must be shifted. She now commences to forge ahead, the after leeches of the mainsail, main and mizzen topsails being full. As soon as it will take the right way, haul out the spanker and bring the ship by the wind on the new tack.

With a slow-working ship, or in a light breeze, you cannot back around stern to wind so easily, but, bringing the wind on the quarter, a vessel will stand so and commence coming to the wrong way. This the judgment of the officer will anticipate and prevent by laying the head yards square (No. 4), which will give her headway; and the helm being shifted, will bring her around, assisted by the after leeches of the after sails and spanker, when it will take (No. 5). In light weather the mainsail may be left down. This is good exercise for the class in charge of the deck during the practice cruise.†

REMARKS ON TACKING.

This evolution, though the most common in the whole practice of seamanship, nevertheless involves points of the nicest judgment and skill to effect its proper performance. In the first place, care must be taken that the ship be *by* the wind, *not* "rap full," and at the same time a point from what she *might* lay; nor *jambed* up to such a pitch as to have no headway at all; but simply, so that all the sails may draw without trembling, and when the least touch of lee helm will cause them to shake. Again, do not put the helm down *suddenly*, but *gradually*, spoke by spoke, which gives the vessel all her velocity in coming to the wind, increasing her distance to windward, and keeping her under command after

* The sails, being hard aback, have the effect of heeling the ship and burying the lee quarter, thus causing her stern to luff more rapidly to the wind, than if the after yards were square, as in box-hauling.

† When beating through the narrow entrance of Narraganset bay, on the night of the 25th of September, 1863, in a fresh whole topsail breeze, the U. S. practice ship "Macedonian" missed stays twice, and was saved from going on the rocks by the performance of this evolution.

REMARKS ON TACKING.

the after yards are swung. If, on the contrary, the vessel be suddenly brought to the wind by the helm being put down *all* at once, the ship will most certainly lose her way, and consequently have sternboard before the head yards are touched. This often leads to missing stays. And here arises another point, viz., the order, "helm's a-lee," should *not* be given until the *jib lifts*, for so long as the sail is full, it is manifestly of service to the ship in staying; and when it shakes it is of no use, and then the sheet may be let go. If, on the contrary, the sheet be eased off beforehand, the sails begins immediately to "flap," and so it will continue until it fills on the other tack, or has altogether prevented the vessel from coming head to wind. The same may be said of the *fore-sheet;* and hence it is, that officers who understand this principle, oftentimes run the lee clew of the fore-sail up to the yard, at the order, "Rise main tack and sheet," which should be given when the *lee* leech of the mainsail lifts. The fore tack, however, should not be eased until after "mainsail haul," for otherwise the entire strain and pressure of the foresail (and that *aback* to), is thus brought upon the bowline.

As with the helm so with the spanker; the sheet must be hauled aft gradually, as the luff of the sail lifts, until the boom is amidships. It is a common error to haul the sheet flat aft at once, thus making a back sail of it.

If the mainsail be hauled before the wind comes ahead, the main yard will fly around of itself; but if it be *not* hauled until the wind comes ahead, or on the other bow, it will occasion a very heavy and tedious haul. Instead, therefore, of watching the lifting of the spanker, or the movements of the dog-vane, observe, rather, when the *weather leech* of the *main topsail* is well *aback*, as the indication when to haul the after yards; and *right* the helm when the wind fills the leech on the other tack. The head yards are then hauled as soon after as possible, observing, first, however, to brace and trim all sharp abaft.

In doubtful cases the windward flap of the spanker will admonish you to haul the main yard; and the pennant at the main will more truly indicate the direction of the wind than the vanes.

In tacking under *double-reefed topsails*, the practice of bracing to the head yards, *while the ship has headway*, should never be resorted to, as tending to destroy not only the effect of the rudder, which is of more consequence, but to check the velocity altogether. Under these circumstances, as soon as the vessel comes up head to sea, and loses her way, put the helm *amidships*, and as she gathers sternboard shift it *gradually*. The chances are then ten to one that she will never "miss stays."

REMARKS ON WEARING.

The very great advantage of using working or preventer main braces, leading forward, is recognized by all who try them. If the after yards are swung at the right moment, they fly around and well up on the other tack, where the main yard may be caught by the forward brace and main-top bowline, if properly worked, *i. e.*, by rounding down on *both parts* at once to get the slack in, and when the yard is *caught* catch a turn with the standing part and proceed to brace up.

In their zeal to shift over the head sheets, forecastle-men sometimes make a back sail of the jibs, causing the ship to refuse stays.

When about to make a good haul of the yards, a few hands should run away with the slack of the brace, the greater number standing by to clap on as soon as the slack is through.

Should a lee top-gallant or royal brace jamb in stays, start the sheets at once. When there is much sea on the bow, or when there is a swell with little wind, the ship will require coaxing. Take opportunities when she is inclining to come to, to haul the head sails down; ease the helm down, haul over the boom, and check the head bowlines and lee head braces. Look out for sternway, and if the sails have taken aback, and it is not intended to use the rudder for steering purposes, put it amidships and secure the wheel. The main yard should not be hauled, nor head sails reset, nor fore tack started until the wind is decidedly on what was the lee bow. The later the haul of the main yard, the heavier will be the work; and as allowing it to bring up square for even a short time would probably cause the ship to miss stays, care should be taken to insure a good haul.

Should a squall strike the ship in stays, up mainsail and spanker, in royals and top-gallant sails, and slack the weather-head braces. If the squall is very heavy, get the vessel before the wind, and clew down; otherwise let go and haul. In *tacking*, never brace to the head yards, unless it be absolutely necessary to prevent the ship from going ashore, or when she has no headway to come round of herself.

NOTE. The jib is a *lifting* sail, and the reason why a ship pitches more with it set, than when hauled down, is *not* that it depresses the bow, but because it raises her higher out of the water, and consequently the ship has a greater distance to fall before the water receives her bow.

REMARKS ON WEARING.

In ordinary cases, let the weather braces be started in *before* putting the helm up, and keep the main topsail leeeches *lifting*;* this

* An exception to this occurs in very light weather, when it is essential that the vessel should have headway to help her go off.

ON SAILING IN LINE.

will bring the ship around (provided she had good headway at the offset) in a very short space. Observe, however, to put the helm up *gradually*, and to brace the after yards entirely round, by the time the ship gets before the wind, letting go the *lee* head braces when the wind gets well abaft, as the forward yards will thus fly nearly square, and save some little pulling and hauling. When the wind draws on the other beam, meet her with the helm, jib, and lee head braces as she comes to.

If a vessel will wear readily, in place of taking in, or lowering a fore-and-aft mainsail altogether, it is better to drop the peak only.

In regard to keeping full the main topsail, while wearing, much depends upon the situation of the mainmast, which, owing to the position of the engine, may step unusually far aft, and the main topsail, by that means, become a luffing sail.

As boats may be made to steer by trimming, so a ship can be made to pay off by bringing the crew aft.

In wearing in a *gale*, two or three heavy seas generally follow each other, and cause the bow of the ship to fall off. This is the time to put the helm up. The main topsail should not be shaken, but kept full, so as to give the ship headway, and when she is nearly before the wind, the weather braces can be easily hauled in. If the foresail is furled, let the head yards remain as they are (viz., aback), to stop the headway as she comes up to the sea on the other tack; brace the main yard sharp, haul taut the weather braces; and after two or three heavy seas pass, let her luff gradually to the wind; and when the headway is deadened, brace around all the yards.

SAILING IN LINE.

When performing any evolution in the line, if sail will insure it, do not hesitate to make a sufficiency, even if it should be taken in immediately afterwards. Missing stays, or taking up much time and space in wearing, throws other ships into danger and disorder.

You may have been carrying enough sail to keep your station, but it does not follow that you have enough to carry you round when the signal for an evolution is made. If your leader is dull, but doing his best and in his station, of course you must not encroach on him; but you must be handy with your canvas, and sharp in freshening your way with it, just before your own turn comes to go about.

When about to leave the main yard square in stays, make a late haul, else the brace will go.

TOWING.

The rule for going about in succession in close order in the line is, to put the helm down when your next ahead is four points on the weather bow; in open order, five points.

In wearing, shiver your after-yards, when your leader is dead to leeward.

As ships when sailing in line are not at liberty to disturb the order of sailing, it should be borne in mind that those emergencies requiring a vessel to be hove to, veered or luffed around on the other tack, must be provided for in some other manner.

This applies to steaming as well as sailing.

CRACKING ON.

"Cracking on" perpetually through everything, conveys the idea of "making a capital passage." Certainly, good runs have been occasionally made under a constant press of sail with continuous breezes, but then experience proves their rarity.

How often, after straining every spar, rope, and sail, wetting and rewetting before the men's clothes have had time to dry, do ships wait for days in stark calms for winds.

It is well to reflect on the risk to the ship, and exposure of the crew, caused by a wanton desire to hold on to the last, and drag through a squall when the case is not urgent. If you are reckless enough to carry on without any precaution in threatening weather, or unfeeling enough to do so with your men "standing by," while you in an armor of waterproof defy the weather, the chances are always in favor of an ugly cloud bringing you wind enough to oblige you to shorten sail. Rain is the general accompaniment; and as the men cannot work in tarpaulins, they are drenched during the operation, and remain so while damages are being repaired, which a little common sense might have avoided.

TO TAKE A SHIP IN TOW, BEING UNDER SAIL OR STEAM.

Having notified the ship of your intention, she will run a little free under easy sail; run along the weather side of the vessel, and when abreast of her, throw overboard the buoy with a light line attached. The ship to be towed grapples the buoy and hauls a hawser aboard.

The vessel to be towed may send her boats with a light line, to haul in the hawser.

TOWING.

TAKING A VESSEL IN TOW, UNDER STEAM.

The vessel having been notified, will send her hauling lines aboard when you have taken up a position ahead. Steamers have bitts to make fast their tow ropes. The vessel towed will take them either to the bitts or capstan.

In taking a vessel in tow from an anchorage, the steamer may be forced to anchor ahead of the ship to be towed, and the latter will first heave up (the hawsers being secured), and then the steamer. The stream cable is the best to use at sea.

In towing *alongside*, have *springs* in addition to bow and quarter fastenings.

This method of towing is not used at sea. In the attack of fortified places, it has been used.

The towing steamer when ahead should use a bridle.

CHAPTER XXV.

WIND BAFFLING.

COMING TO AGAINST THE HELM—TAKEN ABACK—CHAPELLING—TRIMMING YARDS AND REGULATING SAILS FOR CHANGES OF WIND—A CALM—COUNTER-BRACING THE YARDS, ETC.

COMING TO AGAINST THE HELM.

THE sails of a vessel should be always so arranged or trimmed, that she may carry her helm as near as possible amidships, as she is then more completely under its guidance. A vessel that carries a strong weather helm, when by the wind, is liable, by the carelessness of the helmsman, to fly up, and in some cases, too far to be recovered without bracing the yards. Suppose, for instance, you are under all sail, by the wind, on the starboard tack—she comes to against the helm, proceed to recover her on the same tack.

The moment you find her coming to, *Put the helm up! Flatten in the head sheets!* In most cases this is sufficient if the vessel has headway on, and she will fall off · then you may right the helm and *Draw the head sheets!*

TO BOX OFF.

But if she still comes to *against* the helm, *Main clew-garnets and buntlines! Spanker brails! Up mainsail and spanker! Man the weather head braces! Rise fore tack and sheet! Clear away the head bowlines! Brace abox the head yards!* If the wind is not already on the port bow this will effect your object, by boxing her off; and when the after sails fill, let go and haul as in tacking.

If the head yards were not braced abox in time, and the wind is now on the port bow, clear away all the bowlines, and square the yards fore and aft. She will soon gather sternboard and fall off to starboard, from the effect of the helm, which is right for sternboard. As the sails fill, brace in the after yards to keep them shaking, keeping the head yards square; as she gathers headway, shift the helm, and proceed as in box-hauling, which will have the desired effect.

TO CHAPEL SHIP (BY THE WIND ON STARBOARD TACK).

But if, instead of coming to, you are taken aback with a light breeze, to recover her on the same tack, proceed as follows: Put the helm to port, if she has headway on, haul up the mainsail and spanker, and square the after yards; the moment she gets sternboard, shift the helm (putting it to starboard), and she will fall off briskly to starboard. When the after sails fill and she gathers headway, put the helm again to port, and when the wind is astern, brace up the after yards by the port braces; when the spanker will take, haul it out, and bring her by the wind. This is termed "*chapelling*" a ship, by recovering her on the same tack without bracing the head yards.

Sailing in squadron, it is proper, if your ship does not go off by putting up the helm and flattening in the head sheets, to proceed at once to the evolution of tacking, and then, by carrying sail and tacking again when she has gained sufficient headway, return and take your station in the line. By this you will gain your station sooner than if you proceeded as in the preceding paragraph, besides avoiding the probability of compelling other vessels, astern or to leeward of you, to alter their course or leave their stations.

But, having all the sails aback, with the wind on the port bow, it amounts to the same thing whether she came to against the helm or was taken aback by a shift of wind; and in the last question she may be recovered by proceeding as in the former. She will certainly go off more rapidly by bracing the head-yards full, when she has fallen off sufficiently to fill the after sails; and she will come to more rapidly on her original tack by having them square; which considerations give to the former evolution the preference over the latter.

To Chapel Ship without Touching a Brace. This may be accomplished in light weather without touching a rope, excepting, may be, the spanker brails. A light breeze takes you flat aback; order the wheel down (with reference to the way the yards are braced), and as soon as she loses way, *Hard up!* and brail up the spanker. The ship will now gather sternboard, and back around with her stern to the wind. (See "To back a Ship around off a Lee Shore," last chapter.) She will soon bring the wind right aft and come to a stand, when right the helm. She will now gradually gather way, when the after leeches of the sails, assisted by the helm and spanker, when it will take, will bring her to on the old tack. This is not an uncommon practice during mid-watches in the *Doldrums*.

BRACING YARDS.

When the ship comes to on the old tack, by keeping the helm down, she will luff to and catch back again. When she loses headway, shift the helm for sternboard and repeat the operation. In this manner a ship may be kept spinning around for an indefinite period. This is good exercise for the practice cruise, illustrating, as it does, several important points in the handling of a ship.

BRACING IN.

The Wind draws aft. You have directions, as officer of the deck, to make the best of your way on a certain course, which is directly to windward. You are close hauled, under top-gallant sails, on the port tack. The ship comes up gradually to her course, and the wind continues to haul until it is directly aft.

Keep her "*full and by*," that is, as near as she will lie to the wind with the sails all drawing, and she will come up as the wind hauls until "*she is on her course.*" Then give directions to the helmsman to let her come "*no higher.*"

Finding that the wind draws aft, give the order, *Lay aft to the braces! Man the weather main topsail and lee crossjack braces! Clear away the bowlines!* Brace in a little the main topsail, mizzen topsail and upper yards, and then brace in the fore topsail and upper yards, and ease off a little of the fore main, spanker, and jib sheets. *Aloft to loose the royals! Clear away the flying jib! Get the top gallant studding-sails ready for setting!* When ready, LET FALL! SHEET HOME! RIG OUT AND HOIST AWAY! If you carry staysails, you may also set them at this time.

After trimming the after yards, it is customary to order the officer of the forecastle to *Trim the head yards by the main!*

The Wind, still drawing aft, is now abeam. Brace in the after yards as much as the wind will allow, keeping the sails full. Then brace in the head yards, taking in the slack of the top-gallant studding-sail tacks. Ease off the fore, main, spanker, and head sheets, and stand by to set the topmast studding-sail. When ready, *Rig out and hoist away!*

A vessel is "*going large*" when the direction of the wind makes a greater angle than six points (67° 30′) with the course; and when the wind is abeam or a little abaft, forming more than a right angle with the course, when all the sails feel the full force of the wind, then the velocity of the vessel ought to have gained its maximum.

The wind is now on the quarter. Brace the after yards in nearly square, and then the head yards, taking in the slack of the

BRACING YARDS.

studding-sail tacks. *Man the weather main clew-garnet and spanker brails!* Haul up the weather clew of the mainsail, brail up the spanker, and stand by to set the lower studding-sail. When ready, set it.

The wind still draws aft. Square the after yards and then the forward ones; get the lower lifts down to the square mark, and haul down the jib and flying-jib. Man the lee main clew-garnet, buntlines and leechlines, and haul the mainsail up snug. Haul down the staysails.*

The wind is now directly aft. *Stand by to set all the starboard studding-sails!* When ready, hoist the topmast studding-sail up to the lower yard. Man all the halliards, lower-boom topping-lift, forward-guy, in-and-out jiggers, tacks, outhauls; tend the sheets, downhauls, and clewlines. *Haul taut!* RIG OUT! HOIST AWAY!

† In sailing with the wind directly aft, many of the sails are becalmed by those abaft them; the sails on the mizzen-mast keeping the wind from those on the main, which again becalm those on the foremast. The mainmast acting more directly upon the centre of the vessel, should feel the full force of the wind, for which reason you may furl the mizzen top-gallant sail, clew down the mizzen topsail, and haul up the reef-tackles and buntlines. This was formerly termed *scandalizing the mizzen.* Many sails on the foremast being becalmed by those on the main, take them in, as the royals, top-gallant studding-sails, &c.

With the wind aft, if the sea is not perfectly smooth, a vessel will roll more than if the wind were on either side. Care should be taken to keep the yards steady, by hauling well taut the rolling-tackles, and setting well taut the lifts and burtons.

It is a general rule, in trimming the yards for a shift of wind, when the wind draws aft, to brace *in* the after yards first; and when it hauls ahead, the head yards should be braced *up* first.

When the yards are square in port, the lifts should be marked by the captains of the tops and mast men, so that they may, by these marks, always be squared at sea when before the wind, or in coming to anchor; for studding-sails will never set properly on both sides unless the yards are square by the lifts; and in coming to anchor, after the yards are clewed down and braced square, a ship presents a miserable appearance with the yards topped up in every direction.

BRACING UP.

The wind hauls forward. Having the wind aft, under the same orders as in the former question, and all the sails set to the

* Bracing in with stun' sails set, be very careful to clap on the stun' sail halliards, lifts and burtons, and top up as the yards come in. Also keep a strain on the after guy, boom-brace, and topmast stun' sail tack.

† With stun' sails both sides passaree *the foresail.*

BRACING YARDS.

best advantage, the wind hauls forward on the starboard side, until she is close-hauled; proceed to shorten and regulate the sails, and trim the yards, as the wind hauls.

The wind is now on the starboard quarter, the port studding-sails, from the eddy wind out of the topsails, top-gallant sails, and royals, are lifting. *Stand by to dip the port studding-sails!* Having men on the lower, topsail, and top-gallant yards, while you lower on the halliards, they haul down on the inner leeches of the studding-sails, and dip the yards forward; then, *Hoist away!* and now, the studding-sail yards being forward of the sails, the eddy wind has no bad effect upon them. Hoist the mizzen topsail, set the mizzen top-gallant sail, fore and mizzen royals, flying-jib and both fore top-gallant studding-sails, sky-sails, and royal studding-sails, if carried.

When bracing forward, the officer of the deck usually trims the foreyard himself, directing the officer of the forecastle to *Trim the upper yards!*

The wind still hauls forward. It becomes necessary to brace up a little by the port braces. *Stand by to take in all the port studding-sails!* Having everything manned, *Haul taut!* CLEW UP! LOWER AWAY!—HAUL DOWN! RIG IN! The booms being in, and alongside, studding-sails in, the men making them up to stow away, *Lay aft to the braces! Man the port braces, forward guy and fore tack!* Attend the starboard braces, studding-sail tacks, outhaul, and after guy, and let go the lee lower lifts, *Brace up! Haul forward the fore tack!* Trim the upper yards, and lower boom by the fore yard. *Man the main sheet and spanker outhaul!* Let go the main buntlines and leechlines, and have them well overhauled. *Ease down the lee clew-garnet, haul aft! Haul out the spanker! Trim aft the jib sheet!* or if the jib had been hauled down, *Man the jib halliards! Clear away the down-haul!* HOIST AWAY! *Haul taut the weather lifts and braces! Haul out the studding-sail tacks!*

The wind hauls abeam. *Stand by to take in the lower studding-sails, skysails, and royal studding-sails!* When ready, *In lower and royal studding-sails and sky-sails!* Get the lower boom alongside, brace up a little the yards, overhauling the lee lower lifts. *Man the main tack! Ease down the weather clew garnet, haul aboard!* Trim aft the jib sheet, fore, main and spanker sheets.

The wind still hauls, being now forward of the beam; brace the yards sharp up, attending the studding-sail tacks, and overhauling well the lee lifts; haul close down the fore and main

CALM.

tacks, and flat aft the sheets; haul aft the spanker sheet; then haul taut the weather braces, and weather lower lifts.

The wind still hauling the studding-sails lift; *Stand by to take in the studding-sails, royals and staysails!* When ready, *In royals! Lower away, haul down, rig in!* Make up and stow away the studding-sails, trice up the studding-sail gear, and get the burtons off the yards. Trim the yards and sails, and haul the bowlines fore and aft. You are now as you were at the commencement of the question, but on a different tack.

TAKEN ABACK.

The vessel, being on the port tack, is taken aback; or, having come to against the helm, has brought the wind on the starboard bow. When not sailing in squadron, and no other circumstances rendering it necessary to recover her on the same tack, brace around on the starboard tack, as is the most common practice, thus:

If she has headway, put the helm to starboard, brace around the after yards, and proceed in the remainder of the evolution as in tacking. If she has no headway (lying dead in the water when the wind strikes her), up mainsail and spanker, square the after yards, and put the helm to port for sternboard. As she pays off, brace up the after yards by the port braces, and when they fill, *Let go and haul!* as in tacking. Set the mainsail and spanker, trim yards, haul taut the lifts, and haul the bowlines.

CALM.

The yards are braced up on either tack, and the wind has died away until it is perfectly calm.

Haul up the courses, brail up the spanker, and haul down the jib. *Lay aft to the braces!* and counter-brace the yards, either by bracing around the head yards, or the after ones. In this position, which, with a breeze, would keep the vessel stationary, or nearly so, she is ready for any wind that may spring up. If there is any swell on, furl the light sails to save them from chafe.

Suppose, for instance, the head yards are braced up by the starboard, and the after yards by the port braces, helm amidships; a breeze strikes her on the starboard bow; you have only to hoist the jib, and put the helm to port; the sails on the foremast and jib, will pay her off: and when the after sails fill, brace around the head yards.

CALM.

If the wind strikes her on the starboard beam, haul aft the port jib sheet, and brace around the head yards at once.

If the wind strikes her on the port side, from any point that will fill the head yards, haul aft the starboard jib sheet, and brace around the after yards. If too far forward to fill the head yards, brace square the after yards, and put the helm to starboard for sternboard; and when the head yards fill, you may brace up the after yards, and right the helm.

If the wind strikes her ahead, and you wish to pay off to port, haul aft the starboard jib-sheet; the wind now acting upon the head yards abox, and jib, pays her off, while the after yards are becalmed. If she gathers sternboard, put the helm to port, and when she has fallen off sufficiently, *Let go and haul!* as in tacking. If you wish to pay off to starboard, brace the head yards around briskly, haul aft the port jib-sheet, bearing it well out to port, brace square the after yards, and put the helm to starboard for sternboard. As she goes off, brace up the after yards by the starboard braces, and at the proper time, *Let go and haul!* as in tacking.

So you have your vessel, by either process, immediately under command; as soon as she gathers headway, bring her to her course, or by the wind, using the spanker to bring her to, and setting the courses to suit circumstances.

ATTRACTION OF VESSELS TO EACH OTHER, AND OF VESSELS TO THE LAND.

If vessels should be very near each other, though it may be a perfectly dead calm, and the sea as smooth as glass, and even the vessels broadsides to each other; still, experience teaches us, that they will gradually approach until collision takes place. Though the sea may be as smooth as described, still it will always have more or less undulating motion; therefore, the sooner and the more the heads of the two vessels can be brought in opposite directions, the better they will keep clear, because whatever longitudinal motion a vessel receives, has the tendency of making her forge ahead. In the same way, a vessel becalmed near the shore will gradually approach it unless she can be headed to seaward, to do which it may be necessary to send the boats ahead to tow round. If a vessel is required to be towed round quickly, let all the force of boats be put on forward; we mention this, because we have several times seen them divided, one half towing aft, and the other forward, thereby losing the long lever of the bowsprit, or perhaps jib-boom. It has been remarked, that

when large vessels have been set on fire in calm weather, that it has occasioned light airs of wind to blow directly on the fire. This may perhaps be worthy of notice when about to burn towns, shipping, &c., as the change of light breezes directly out of port to the same breezes directly in, may be of consequence, unless on board of steamers.

ON KEEPING A SHIP'S HEAD THE RIGHT WAY IN LIGHT AIRS OR CALMS, ETC.

So much are the best seamen impressed with an idea of the necessity of keeping a ship's head the right way, that whenever they have an object to gain, they are always most particular on this point. See Capt. Brenton's Naval History, Volume I., page 379, Lord Bridport's Action off Ushant. "Sir Andrew Douglass, the captain of the 'Queen Charlotte,' with becoming zeal for the service, and that constant attention to his duty, by which he had risen in his profession, used the utmost exertion during the night, to keep the ship's head directed towards the enemy, well knowing that with the motion of the sails, occasioned by the swell of the sea, a ship will forge ahead. In consequence of this, at daylight he was one of the nearest ships, when a breeze springing up, he very soon had the distinguished honor of being again closely engaged on both sides." Every seaman knows, that even in calm weather, with the least swell, if you put two ships' heads in opposite directions, they will soon separate, and continue to do so until both their heads are put in the same way. This does not appear to arise so much from the flapping of the sails, as Capt. Brenton observes, as it does from the formation of a ship's bottom.

CHAPTER XXVI.

TWO OR MORE VESSELS COMMUNICATING AT SEA—HEAVING TO—FILLING AWAY—STRUCK BY A SQUALL—MAN OVERBOARD—SOUNDING.

In the previous chapter, we counter-braced the yards in a calm to prepare for a breeze, but yards are frequently braced in this manner, with a breeze, for the purpose of *heaving to*, to await the coming up of, or to speak another vessel; for the purpose of sounding; to lower a boat in case a person has fallen overboard; or in any case where you may wish to remain stationary.

The most common practice in vessels sailing alone, is after hauling up the mainsail, to brace square the main yard—that is, yards on the main mast—having the fore and cross-jack yards braced full, foresail, spanker and jib, set. Though the sails on the main mast are aback, she will range ahead slowly.

To stop her way still more, brace the cross-jack yards square, haul up the foresail, and put the helm a-lee; she will rarely range ahead under this arrangement of the sails, but will fall off and come to, which you may regulate by easing off, or hauling aft, the spanker and jib sheets.

Or you may brace abox the head yards, and keep the after ones full. The after sails will keep her by the wind, while the head sails will deaden her headway.

It must depend entirely upon circumstances which method is resorted to. A vessel alone will back the main topsail. To save a man overboard, back the main and mizzen topsails.

Two vessels communicating, the weather one braces aback her main yard, the lee one her head yards; then, on any sudden emergency, as a squall, the weather one throws all aback and drops astern, while the lee one shivers her after yards and falls off.

If there are *three* vessels, the centre and weather ones back their main yards, and the lee one as before; then, in case of necessity, the weather one fills her after yards and shoots ahead, the centre one backs astern, and the lee one proceeds as before.

Sailing in squadron in "order of sailing," those vessels which have the advantage in speed over others, are obliged frequently,

STRUCK BY A SQUALL.

besides reducing sail, to back the mizzen topsail, for the purpose of keeping in their stations. This is frequently done in preference to furling royals and top-gallant sails. A fast-sailing vessel will sometimes keep her station for hours, with her mizzen topsail aback.

TO HEAVE TO, HAVING THE WIND AFT, OR ON THE QUARTER.

After hauling up the courses, commence as in bringing to the wind, brace the mizzen topsail sharp up, put the helm down, and when the spanker will take the right way, haul it out. Keep the main topsail square, and meet her, as she comes to, with the helm, and by bracing up the head yards, and hauling aft the head sheets.

UNDER SIMILAR CIRCUMSTANCES, TO HEAVE TO WITH THE FORE TOPSAIL TO THE MAST.

After hauling up the courses, brace up the main and mizzen topsails, when you put the helm down; keeping the head yards square, and hauling flat aft the jib-sheet. It may be necessary to meet her with the helm, and ease the spanker sheet, before she loses her headway, to prevent her coming around or going about.

If a vessel has a rapid headway when the necessity for heaving to occurs, it would be advisable to settle down the top-gallant sails and royals, or clew them up; for these sails, when thus thrown aback, receive the full impulse of the wind, increased by the heading of the vessel, and the mast thus pressed has not a sufficient support from its stay.

To fill away, after lying to with the main topsail to the mast: *Right the helm, haul aft the head sheets!* and board the fore tack. As she falls off, brace up the after yards, set the mainsail, and trim to the course. If from lying to with the fore topsail to the mast: *Right the helm!* shiver the after sails and haul aft the jib-sheet. As she falls off, brace around the head yards. Meet her with the helm, and trim to the course.

In the foregoing cases, vessels are said to be "*Lying to with the main topsail to the mast;*" "*Fore topsail to the mast;*" "*After yards aback;*" or, "*Standing on with the mizzen topsail aback.*"

Ships running with the wind aft may decrease their speed by "bracing by," thus spilling the wind out of their sails.

STRUCK BY A SQUALL UNDER ALL SAIL.

Sailing with the wind on the starboard quarter under royals, flying-jib, staysails, and all the starboard studding-sails, "alow and aloft," you are struck by a heavy squall.

STRUCK BY A SQUALL.

The first and most important thing to be done is, to get your vessel before the wind, which destroys greatly its force, and becalms many of the sails; and the next is, to reduce sail as expeditiously as possible.

Hard up! Let go the main and spanker sheet, and outhaul! Clew up the royals and top-gallant sails, and haul down the top-gallant studding-sail and flying-jib, clew down the mizzen top-sail, haul up the mainsail and spanker, then take in the lower and topmast studding sails, and haul down the staysails, rig the booms in, and take the burtons off the yards. When before the wind, right the helm, clew down the topsails, haul out the reef-tackles, and up the buntlines, haul down the jib and hoist the fore topmast staysail. In the meantime, furl the top-gallant sails and royals, and stow the light sails; and you may now run before the squall until it moderates, or bring by the wind and reef, before keeping on your course.

The lower and topmast studding-sails assist in paying her off, and should be kept on if possible, until she is before the wind; for a vessel in a squall is apt to fly up into the wind, unless means are taken promptly to prevent it, by the helm and sails.

ON THE BEARING OF AN OFFICER OF THE DECK.

In this, as well as in every other evolution, where despatch is necessary, an officer should be well prepared as to the first and most important orders to be given. As previously observed, he should accustom himself, while in charge of the deck, to imagine every exigency, and determine upon the proper orders; by this, he prepares himself for any that may occur, and is always ready and prompt in issuing those orders, that lead to the most important results. In the last case, his first object must be to get the vessel before the wind; after which, his judgment must direct him, in the next, of reducing sail. The only rules that can be laid down, are those that regulate which sails are taken in together, to take in the lighter sails first, and then the heavier ones; to be as expeditious as possible; and to reduce sail (in extent) according to the strength or violence of the squall.

In every sudden call upon a crew for great exertion, unless they are in a good state of discipline, and well acquainted with all their different stations for every manœuvre, they are at once thrown into a state of great confusion, impeding rather than forwarding the intention or wish of the officer of the deck. They should be taught to preserve the strictest silence, for nothing adds more to the general confusion in such cases, than a babel of many voices.

MAN OVERBOARD.

But more than all this, upon the manner and bearing of the officer of the deck depends the success or failure of any measure. If he displays promptness, decision, coolness, and issues his orders distinctly and with confidence, he communicates at once, to the whole machinery, an influence that regulates, commands obedience, and leads to success. If, on the other hand, he is agitated, commands and countermands in the same breath, and is rather led into measures than directing them, confusion, noise, and irregularity, mark the whole proceeding, and delay the accomplishment of the intended manœuvre.

In most cases, an officer who keeps a vigilant watch can see the approach of a squall, and anticipate it by reducing sail, and be ready to brace yards and meet it; for rarely do squalls occur without something to mark their approach—either the appearance of the clouds and horizon, or the commotion on the water; of the one, experience and careful observation from time to time will prepare him to judge very accurately; the latter cannot be mistaken, and invariably marks the advance of a sudden and violent squall.

No part of the horizon should escape his observation during his watch, even in the finest weather with a steady breeze. It will encourage a habit that must turn to good account, and never be a useless one; he may see by this, the approach of a squall from a point directly opposite to the breeze, which appears to be a steady one, and prepare himself by reducing sail in time.

Too much cannot be said in censure of an officer in charge of the deck, intrusted with the safety of a public vessel, and the lives of hundreds of persons, who, performing his duty negligently, allows a squall to strike him without seeing its approach, and consequently unprepared to meet and resist its effects; by allowing other matters to occupy his thoughts and attention during his watch, he is thrown entirely off his balance at any unusual occurrence, creates, by his manner and conduct, confusion among the men, and losing their confidence, at the same time loses their respect, and proper deference to his orders.

A MAN OVERBOARD.

You are suddenly startled by the cry of "A man overboard!"

There is nothing on board of a vessel that creates for the moment a greater excitement, or spreads a more general panic over the whole crew. Their best feelings and energies are suddenly excited, and forgetful of every other consideration than that of extending an arm to save a fellow-being, they rush aft

in a body, without a thought, or settled purpose of action. Here the influence of the officer must be exerted promptly, and on the instant, to turn their feelings and energies in the proper direction, to the only mode of rescue.

The moment the cry is heard, you should order, *Hard down! Let go the life buoys!* Whether sailing free or on the wind, bring her up and shake the sails, which will deaden her headway, until you can reduce sail and heave her to; for while headway continues, though diminishing, you can by the helm keep her lifting, and prevent her being taken aback. In the meantime, issue the following orders distinctly, and in a manner that will command instant obedience:—*Silence fore and aft! Every man to his station!* Clear away the lee cutter!*

The best authorities recommend, that, if possible, the ship should not only be hove aback when a man falls overboard, but that she ought to *be brought completely round on the other tack*, if the vessel was on the wind, and with a stiff breeze; for she will then, having her main yard aback, drift down directly toward the man. Therefore, if on the wind, the officer should order, *Ready about!* hauling up the mainsail in stays.

If on the wind, and there are reasons for not going about, *Main clew-garnets and buntlines! Weather main and lee cross-jack braces! Clear away the bo'lines!* UP MAINSAIL! BRACE ABACK! The moment the lee braces and bowlines are let go, the yards (from being already in the wind) will fly round themselves; then keep the head yards full to steady her, while the after ones stop her headway.

While this is being done, the boat is ready for lowering, with the crew and an officer in her; *Lower away!* and direct them which way to pull.

Great care must be taken to lower the boat at the proper moment, as soon as the vessel's headway has sufficiently ceased, to insure the safety of the boat. An attempt to lower the boat too soon may prevent your saving the man, and endanger the boat's crew.

If the manœuvre is performed readily, and in the shortest time possible, the officer of the deck, though he may lose the man, can only feel, in common with all on board, a regret at the melancholy accident, without having upon his conscience the bitter feeling that he might have saved him.

It may be proper here to remark, that, in many cases, the lives of some of the crew, particularly those stationed on the yards,

* Every vessel should have a particular station bill for this emergency, and test its merits by practice.

are frequently endangered by the negligence of those who are attending the braces. The officer should be particular, when the men are on the yards, to keep the braces fast; and, if necessary to brace them, have the braces well attended, and give them timely notice of his intention, warning them to "*Look out for themselves!*"

There are cases in which an officer may have reason to hesitate as to the propriety of lowering a boat to rescue a man, such as in a gale of wind with a heavy sea, or in a dark, squally night. The struggle, in such a case, will be great between his better feelings and his judgment. The former might induce him to risk his own life to save a fellow-being, but he has no right to risk the lives of a whole boat's crew in a hopeless attempt to save one man; his responsibility will be great, but his judgment must direct him.

In these, as in most cases, a sailor will rush blindly into any danger, under the orders of an officer he respects; and an officer cannot be too careful in subjecting these most willing instruments to unnecessary or too perilous situations.

Wind on the starboard quarter, starboard Studding-sails set. Although the method of "rounding to" with the *after* yards to the mast is advocated by some authorities, it cannot be recommended as the best; nor is it, indeed, in accordance with the practice of our best officers, which has always been to *luff to with the head yards aback.* The lower stun'-sail should be clewed up, head sheets and stun'-sail tacks and sheets let fly, and the royals clewed up; the lee clew of the mainsail and foresail hauled up and the spanker set.

The following commands may be used:

Hard down! Let go the life buoy! Clear away the lee cutter!

Port main, starboard cross-jack braces! Brace up! Let fly stun' sail tacks and sheets! Clew up the lower stun'-sail! Fore and main clew garnets and buntlines! Up courses!

By this arrangement of canvas the ship may be held steady until the return of the boat. The officer of the forecastle may now haul down the stun'-sails, and get things to rights forward. The booms may be left out. When coming to the wind in a fresh breeze, clew up the royals and settle down the top-gallant halliards.

In this case the boat pulls off on the weather beam.

Wind aft, and Studding-sails both sides. Round to on either tack (the particular one determined in the mind of the officer on

MAN OVERBOARD.

first assuming charge of the deck), brace up the after yards, and luff to with the head yards square. Haul out the spanker. Let fly stun'-sail tacks and sheets on the side you are coming to. Take in the lee stun'-sails as fast as possible, and then the weather ones. Up foresail and reduce sail as necessary. The officer of the deck should bear in mind the following: first, to keep cool himself; second, to preserve order; third, to let go the life buoy; fourth, to put the helm down; fifth, to keep sight of the man; sixth to heave to; seventh, to lower the boat; eighth, to make all snug, and if at night to hoist a light. If necessary he should wear and run to leeward to pick up the boat having everything ready for hoisting.

MAN OVERBOARD—GENERAL REMARKS.

Almost every ship has a particular station bill for this occurrence, but as it happens under so many different circumstances, it is impossible to prescribe. The best preconcerted arrangements are often inapplicable, and success depends mainly on the presence of mind of the officer of the watch, the man at the life buoy, *and the normal condition of the boats.*

A cool hand will drop the life buoy sometimes within reach of a man; a "bothered" one will either not let go at all, or do so before the man has got near the stern.

Boyd says: If on a wind, there can be no question about "going about;" leaving the main yard square on the other tack, and lowering the boats when ready. If sailing off the wind, everything light must be let fly, the weather clew-garnets run up, after yards braced up, and the ship rounded to. Or, if well manned, wear; shorten sail, and stand towards the man on the other tack.* Hands with their wits about them must endeavor from aloft to keep the man in sight. The boat's pennants and the "pull to port," "pull to starboard," and "you go well" signals must be bent on instantly, so as to be ready to hoist and correct each other. If at night, have blue lights and rockets ready for showing the ship's position to the boat. If in the fleet, the ship's position lights should be shown as quickly as possible. As the boats are supposed *always* to have the means of flashing or firing, you will know their whereabouts.

Netfuls of cork shavings or old corks kept at different parts of the upper deck, are most useful while bathing; the men are encouraged to "take the water," knowing that one of these will be pitched right into his hands when he is fatigued; and, in the case

* In all cases of letting fly gear suddenly, never forget to warn the lookout men who are on the yards.

MAN OVERBOARD.

of a man overboard, it will most probably be in the power of the person who gives the alarm thus to afford immediate relief. They can also be sent in boats when you must risk a capsize.

It is recommended by some, in such a contingency, to square the main yard and heave to at once; but such a recommendation overlooks the possibility of ships sailing in line and being disconcerted, if not imperilled, by the obstruction.

The opinion of officers of high reputation and general experience, who have written on this subject, may be profitably reproduced.

The most important considerations, when a man falls overboard, are: First, the quickest and most effectual method of arresting the ship's progress, and how to keep her as near the spot where the man fell as possible.

Secondly, to preserve entire, during these evolutions, the general discipline of the ship, to maintain silence, and to enforce the most prompt obedience, without permitting foolhardy volunteering of any kind.

Thirdly, to see that the boat appointed to be employed on these occasions is secured in such a manner that she may be cast loose in a moment, and when ready for lowering, that she is properly manned and fitted, so as to be efficient in all respects when she reaches the water.

Fourthly, to take care in lowering the boat, neither to stave or swamp her, nor to pitch the men out.

And, lastly, to have a sufficient number of the sharpest sighted men in the ship stationed aloft, in such a manner as to give them the best chance, not only of discovering the person who is overboard, but of pointing him out to the people in the boat, who may not otherwise know in what direction to pull.

It is conceived that all these objects may be accomplished with very little, if any, additional trouble, in all tolerably well-disciplined ships.

Various opinions prevail among officers as to the first point, but I* think, the best authorities recommend that, if possible, the ship should not merely be hove aback when a man falls overboard, but that she ought to be brought completely round on the other tack. Of course, sail should be shortened in stays, and the main yard left square. This plan implies that the ship being on a wind, or from that position to having the wind not above two points abaft the beam. But, on one tack or the other, this will include a large portion of the sailing of every ship.

* Captain Boyd R. N.

MAN OVERBOARD.

The great merit of such a method of proceeding is, that if the evolution succeeds, the ship, when round, will drift right down towards the man. And, although there may be some small risk in lowering the boat in stays, from the ship having at one period sternway, there will, in fact, be little time lost if the boat be not lowered till the ship be well round, and the sternway at an end.

There is more mischief done generally by lowering the boat too soon, than by waiting till the fittest moment arrives for doing it coolly. And it cannot be too often repeated, that almost the whole depends upon the self-possession of the officer of the watch. This important quality is best taught (like everything else of the kind) by experience—that is to say, by a thorough and familiar practical knowledge of what is right to be done under all circumstances.

It may be permitted for every other person in the ship to feel alarmed and shocked when the sounds reach his ears indicative that a man is overboard; but the officer in command of the deck ought to let it be seen and felt, by his tone of voice, and by the judicious promptitude of his orders, that he, at least, is perfectly master of himself, and knows distinctly what course it is best to adopt.

"If the ship be running before the wind, or be sailing large and under a press of sail. the officer must exercise his judgment in rounding to, and take care, in his anxiety to save the man, not to let the masts go over the side. If the top-gallant sheets, the topsail, and top-gallant halliards, be let fly, and the head yards braced quickly up, it will hardly be possible to bring her about. Still, I am so strong an advocate for the principle of tacking, instead of merely lying to, when a man is overboard, that, even under the circumstances above described, as soon as the boat was lowered and sent off, and the extra sail gathered in, I would fill, stand on till the ship had gained headway enough to render the evolution certain, and then go about, so as to bring her head towards the boat."*

"If the occurrence should take place when the ship is close-hauled, and no doubt about tacking, the best officers are of the opinion that the ship should be tacked immediately, squaring the main yard, and lowering the quarter boat or boats in stays. I have seen this tried several times by throwing pieces of wood overboard from different parts of the ship; these pieces of wood generally came between the lee bow and lee quarter, after the ship was well round on the other tack. If a man should fall over-

* Captain Basil Hall's Fragments.

board when the ship is before the wind, round her to immediately with the head yards aback."*

"It matters little what manœuvre a ship goes through provided she gets her boat away in safety, and avoids sternway. . . . . To lower the boat with any degree of safety, the vessel's way must be either stopped, or, at all events, deadened. The manœuvre which subjects a vessel to control under head and not sternway is, in all cases, the one to adopt. If the officer of the watch allows the main yard to fly square before he has taken the mainsail off the ship, or, at all events one of its clews, it will defy the efforts, not only of his watch, but of the hands themselves as they run on deck, to haul it up.

"The manœuvre of tacking and heaving to are open to certain objections, which seem hardly to be counterbalanced by the advantages which it offers. The 'lee boat' is always specified in the order as the one to be lowered; and as this order would, in all probability, be carried literally into effect, the officer of the watch would find himself, after having gone smartly about, dealing with a boat on his weather quarter.

"The advantages consist in this, that the ship, owing to the change of tack, naturally drifts towards the man, giving the boat a less distance to pull."†

When it is borne in mind that in the line there would be no alternative —that a mistake about a lee boat could be guarded against by using the term starboard or port—that, in the event of the boats being scarce able to live, or having shipped water, lost oars, or of their crews being exhausted, the ship would, by tacking, be in the immediate position for affording succor; the subject is left to the reader as one deserving of the greatest consideration.

Life Buoys. The common-service life buoy always capsizes when a drowning man clings to it, owing to his trying to get as high out of water as possible.

It is intended for him to place his feet on the bottom step, but as that keeps his head only above water, few men have the presence of mind to trim it properly.

If at night, the match must be lighted before the buoy is let go. The right handle is to light the match, and the left hand one to let go the buoy.

If the right handle is painted red and the left hand one white, they can be easily distinguished apart in the darkest night.

* Captain Liardet's Professional Recollections.

† Captain Kynaston, on Casualties at Sea.

COLLISION.

Circular life buoys should be distributed about the upper deck, for, in the new long ships, a buoy thrown out from the gangway often falls closer to the man, if he has fallen overboard from forward, than the one thrown from aft.

In the absence of all experience even, one cannot fail to be impressed, by the foregoing remarks, with the necessity of perfecting, as far as possible, the arrangements of the outside boats; and this is accomplished, in a great measure, by the apparatus described in the chapter on BOATS.

A little exercise in picking up buoys, under various circumstances at sea, will rob the "startling cry" of much of its terror, and accustom both the officer of the deck and the watch to that kind of work.

COLLISION.

On a collision in steaming, upright the screw. In that case gear dragging overboard will not foul it, otherwise it will.

On a collision taking place when in soundings, it is generally best for the weathermost ship to anchor.

When two ships are becalmed near each other, either send the boats of both to tow the lighter, or of the one that lies in the most favorable position (with reference to swell) for being moved; or else, run warps out from the quarter of one to the bow of the other, or *vice versa*, and both may thus be sprung ahead and steered clear of each other.

In passing dangerously close by another ship or other obstacle, remember that when the helm is put over to prevent collision, it is the stern that moves, and that while the bow may be thus saved from touching, the stern may be fouled; but that if the helm be quickly shifted when the bow is *just* clear, the stern will be thrown out. Many a "*touch-and-go shave*" has been thus effected by judgment and nerve. This is a good practical hint, and one worth remembering.

SOUNDING.

In a light breeze, with the wind free and all sail set, soundings may be taken without reducing sail, thus: Luff the ship up, if the lower stun'-sail is set haul up the clew line, and keep the sails lifting, without allowing them to catch aback, which can readily be done by a proper management of the helm; she will lose her headway sufficiently for the purpose, and still be under control of the helm. The soundings being taken, keep her off to her course, and haul out the lower stun'-sail.

SOUNDING.

The operation of obtaining soundings, particularly when going large, affords a fine opportunity for the display of skill and judgment in handling a ship. Celerity and certainty are generally aimed at, but very frequently is the one needlessly sacrificed for the other. Full preparation should be made first with the lead and line. The sails and helm must then be managed so as to bring the ship as nearly stationary as possible without endangering the spars. As soon as the headway ceases, or nearly so, get a *fair up and down cast*, and fill away.

The common error is to heave with too much way on. Instead of saving, this only wastes time, for if the soundings are necessary at all, they should be determined correctly.

On a wind haul up the main sail and back the main topsail. In addition to this the mizzen topsail may be thrown aback if found necessary.

In a steamer, if going too fast, it is only necessary to "slow down" the engine.

CHAPTER XXVII.

REEFING AND HOISTING—TURNING OUT REEFS—REEFING IN STAYS.

REEFING AND HOISTING.

WHEN it becomes necessary to reduce sail by reefing the topsails, *All hands reef topsails!*

Man the topsail clewlines and buntlines, weather topsail braces! Have hands by the lee braces, bowlines, and halliards.

When ready—

Clear away the bowlines, round in the weather braces! Settle away the topsail halliards! CLEW DOWN! Brace the yard in so that the lee topmast rigging may not prevent it from being clewed down to the cap; haul up the buntlines, and haul out the reef-tackles, while the yard comes down; and when it is down on the cap, steady the yard by the lee braces, and haul taut the halliards.

HAUL OUT THE REEF TACKLES!

HAUL UP THE BUNTLINES!

ALOFT TOPMEN! *Trice up, lay out, and take one reef! Light out to windward!* Pass the weather earing forward and over the yard, rousing the reef-cringle well up, and expending the earing in turns through the cringle and over the yard, except sufficient to secure its end; then *Haul out to leeward!* hauling the reef-band well taut; and pass the lee earing in the same manner as the weather one. When they are secured, tie the reef-points, hauling the sail well up on the yard by the forward legs.

While the men are reefing, luff the ship up and spill the sail, that they may gather it up readily. Pass the after reef-points clear of the top-gallant sheets; that is, between them and the yard, and be particular that the reef-points are all tied.

Stand by the booms!

Lay in! Down booms! LAY DOWN FROM ALOFT! *Man the topsail halliards! Let go and overhaul the rigging!* Clear away the buntlines, clewlines, and reef-tackles, and have them lighted up. *Tend the braces!* Let go the lee ones, and stand by to slack the weather ones. *Set taut!* HOIST AWAY THE TOPSAILS! When up

REEFING.

"a taut leech," *Belay the topsail halliards!* Trim the yards, *Steady out the bowlines!* and pipe down.

Be particular to brace the topsail yards well in before you *let go* the halliards, or you will endanger your lee topmast rigging. And after reefing and hoisting the sail see that the hanging mats are shifted on the rigging in the wake of the topsail yard.

When short-handed or working with the watch, clew the yards down, and get all ready for reefing before starting the men up; but with all hands, the topmen may be sent aloft at once, and ordered out as soon as the yards are on the cap, and the braces steadied taut.

In a seaway, and the vessel pitching, do not hoist the sails, or haul the braces, too taut; it endangers the yard and the rigging; the lee braces should be kept slack to allow the yard a little play, but be particular that though the brace is slack, it is securely belayed to its pin.

Frequently, top-gallant sails are set when you are about to reef the topsails, and if you intend to set them again after the topsail is reefed, clew the sail up; or you may merely let go the sheets, and light them up as the topsail yard comes down, without taking them in; and after the topsail is mast-headed, sheet home the top-gallant sails, settling down the top-gallant halliards to let the sheets go home.

If the wind still increases, and it becomes necessary to reduce sail still further, clew up and furl the top-gallant sails, then take a *second* and a *third* reef, proceeding as in the first, having each successive reef band immediately below the preceding one.

And to reduce sail still further, by taking the last or *close* reef, pass the earings abaft and over the yard, bring the reef-band under the yard, and covering the other reefs. It will be necessary in this reef to haul the reef tackles close up, to do which you will be obliged to start a little of the topsail sheets, or to brace in a little of the lower yards.

After taking the third reef in your topsails, it is advisable to get *preventer braces* on the weather topsail yard-arms, particularly if the braces are much worn.

Bracing in a topsail-yard for reefing, in a fresh breeze, requires great force, and not unfrequently the brace, from being much worn, becomes stranded; as soon as you discover it, put on a good stopper above the strand, man the weather clewline and clew the sail up, bend the lee bowline to the extremity of the lee yard arm, and get a preventer-brace on the weather one; then,

and by these, brace in the yard and clew it down; and while you are reeving new braces or splicing old ones, steady the yard by the bowlines bent to both yard-arms, as before directed.

After hoisting a close-reefed topsail, haul taut the reef tackles, so that they may bear a strain to relieve the reef earing, and be particular that the yard is hoisted clear of the lower cap. Send the men down from aloft, haul home the sheets, trim the yards, and haul the bowlines.

The mizzen topsail is generally furled when the fore and main are close reefed.

To reef Topsails before the Wind, you may, by putting the helm either way, and bringing the wind abeam, clew the yards down as the sails lift, and keep her in this position until they are reefed; or if you wish to continue on your course, wind blowing very fresh, clew the yards down, clew the sails up, and then reef as before directed, or *brace by*, spilling the wind out of the sails.

To reef a Course. Having the reef-pendants hooked to their cringles, on the leeches of the sail, hook the clew-jiggers, or a burton from the lower mast-head, to the thimble in the upper end of the pendant; *Man the clew-garnets, buntlines and leechlines!* and haul the sail up as in a fresh breeze. Haul well taut both lifts and rolling tackles. *Haul out the reef tackles!* slacking the clew-garnets, if necessary, to get them well up. *Lay aloft lower yard-men! Man the boom tricing-lines! Trice up, lay out and reef!* Proceed in reefing as in taking the first reef in a topsail, being careful to secure every reef point to the jackstay. *Lay in! Down booms! Lay down from aloft!* Let go and overhaul the reef tackles, and set the sail.

Top-gallant sails have sometimes reef-bands fitted with points, and may be reefed as you would reef a topsail, but this is rarely done. When it blows too fresh to carry a whole top-gallant sail over a single-reefed topsail it is time to furl it.

A topmast studding-sail, when set with a reefed topsail before the wind, must also be reefed; this is done on deck before setting the sail.

To shake or turn a Reef out of a Topsail. *Haul taut the reef-tackles and buntlines! Settle a little of the topsail halliards!* to take the strain off the leeches of the sail and reef-earing. Send aloft the quarter-watch. Cast off the reef-points from the slings, as they lay out, and have the earings ready to ease away; when the reef-points are all clear, *Ease away! Let go and overhaul all the rigging!* reef-tackles, buntlines, clew lines and top-gallant sheets. *Lay in off the yards! Lay down from aloft!* Man the

topsail halliards! Tend the braces! Hoist away the topsails! Trim the yards, and if on a wind, haul the bowlines.

To turn a Reef out of a Course, proceed as in a topsail, easing off the tack and sheet to relieve the strain on the leeches of the sail, while you are hauling taut the reef-tackles; when done, haul aboard the tack, and aft the sheet.

GOING LARGE UNDER ALL SAIL, TO ROUND TO UNDER SINGLE REEFS.

Sailing with the wind on the starboard quarter under royals, flying-jib, staysails, and all the starboard studding-sails, "alow and aloft"—a signal is made to come to on the port tack, with the main topsail to the mast, under single-reefed topsails.

In obeying this signal, it will be your object to reduce sail, and reef your topsail in wearing; thus—

Call all hands to shorten sail. *Stand by to take in the studding-staysails, royals, and flying-jib!* When everything is well manned, order, *Haul taut! In stun'-sails, and royals, down staysails and flying-jib!* Rig in and get alongside the booms, take the burtons off the topsail yard, and jiggers off the top-gallant lifts. Furl the royals, haul down and stow the staysails and flying-jib, make up and stow away the studding-sails.

Man the top-gallant clewlines, lee main clew-garnet, and buntlines! Spanker brails! When manned, *In top-gallant sails! Up main-sail and spanker! Aloft and furl the top-gallant sails!* Haul the mainsail up snug.

Stations for wearing! And proceed as directed in "Wearing," Chapter XXIV. until the wind is right aft; when, the after yards being square, square also the head yards. *Shift over the head sheets!*

Man the topsail clewlines, buntlines, and reef-tackles! Lay aloft top-men! Let go the topsail halliards, clew down! Haul out the reef-tackles! Haul up the buntlines! Steady the topsail yards by the braces. *Trice up! Lay out! Take one reef in the topsails!* Shift over the spanker boom.

The vessel going around, brings the wind on the port quarter; brace up the cross-jack yard, and as she comes to, bringing the wind abeam, meet her with the helm, haul aft the jib-sheet, brace up the fore yard, and haul forward the port fore tack. *Lay in! Down booms! Lay down from aloft! Man the topsail halliards!* Clear away and light up all the rigging. *Attend the braces! Hoist away the topsails!* Having mastheaded the topsails, brace

up and trim the fore and mizzen topsail yards. Haul taut the lifts and braces, and pipe down.

Use the spanker, if necessary, to keep the topsails lifting while you are reefing; and when reefed, to bring her by the wind, and keep her from falling off.

After taking in the studding-sails, being in a hurry to perform the remainder of the evolution, merely remove them from out the way of the rigging, and make them up while the topmen are reefing, or after the evolution is accomplished.

TO REEF TOPSAILS IN STAYS.

Call all hands, '*Bout ship and reef topsails!* send aloft one watch of topmen, and see the remainder properly stationed; ease down the helm and haul over the spanker-sheet as she comes to; overhaul the weather lifts, and when hard down, "helm's a-lee," ease off the jib, and if necessary, the fore sheet; when the lee leeches of the courses shake, "rise tacks and sheets;" when the wind is about a point on the weather bow, stand by the main and mizzen topsail halliards, "mainsail haul," let go the main and mizzen topsail halliards, and take care not to brace up the yards too much; let the men from the clew-garnets and braces haul out the reef-tackles and up buntlines, *Trice up, lay out and reef! Man the head braces!* when head to wind, shift over the head sheets, bear over the spanker boom, and haul aft the jib-sheet as soon as it will take; when she gets sternboard, shift the helm, when the mainsail and spanker are full, stand by the fore topsail halliards. *Let go and haul!* ease away the halliards and let the men from the jib-brails and fore clew-garnets haul out the reef-tackles and up buntlines, avast bracing, *Trice up, lay out and reef!* As soon as the main and mizzen topsails are reefed, let the men lay in, down booms and overhaul the rigging; lay down, lead along and man the halliards; attend the braces, hoist away and trim the topsails which will catch her in falling off; as soon as the fore topsail is reefed send the men down; brace up the fore yard, lead along and man the halliards; hoist and trim the sail; trim all sharp, haul the bowlines, haul taut lifts and braces, clear up the decks and pipe down.

GENERAL REMARKS ON REEFING.

In clewing down to reef, luff the ship to, with a steady helm, and meet her when she shakes. Clear away the bowlines, settle a little of the halliards, and *then* round in the weather braces. By adopting this precaution, the sails are more easily spilled,

REEFING.

and by hauling on the weather braces, they serve not only to keep the yard in, but to bring it down also, which would *not* be the case were the halliards kept fast until afterwards. Much depends upon the manner in which the sails are laid for reefing; for this reason it is deemed best by experienced seamen to keep the courses, which should be set, *full*, and to brace the upper yards in, sufficient to make the topsails lay "alive;" or in other words, so that the wind will *cut*, as it were, the *weather-leech* in two, and leave the canvas hanging loose.*

The reef-earings of the topsails are passed as follows:—

For the first, second, and third reefs, take the earing up from the sail, and pass it on the fore-side of the yard, round the cleat for that purpose, through the cringle, until two, three, or four outer turns (according to the reef), be passed; then reeve the bight through the cringle from *aft* forward, taking a round turn in the cringle, and passing the end from the cringle, *under* the yard, up aloft, over and through the bight, then back over the yard on the fore-side, through the cringle from underneath the yard; slew the cringle well up; pass sufficient turns to secure; expend the end round the yard, ultimately taking a half-hitch round its own parts close down.

The fourth, or close reef, is passed in a similar manner, with the exception of taking the *first* turns on the *after*, instead of the fore side of the yard, in order to cover the other reefs, and to keep the cringle close up to the yard. The *outer* turns to be passed for each reef as follows: *two* for the first reef, *three* for the second and third, and *four* for the fourth. The use of the outer turns is merely to keep the head of the sail on the stretch; whereas the *inner* turns have the whole strain of the leech to bear when the sail is hoisted and the bowline hauled.

In reefing the *courses*, the better way is to haul them up. The *first* reef-earing is then passed from *forward*, *aft*, over a small hook seized to the forward part of the strap of the lift-block, having the point of the hook out-board. The legs are then taken with a round-turn around the jack-stay, and a single hitch, with the bight made around the standing-part. The *second* reef-earing is passed outside of the lift, from *aft*, *forward*, round the yard, clear of the topsail sheets, and hitched to its own parts.

In reefing a *spanker*, tend the throat and peak halliards, and lower the gaff as far as necessary—hauling on the weather vang, and down on the leech at the same time. Reeve the earing through the cringle, haul it taut, and pass it around the *clew* of

* In the merchant service, in reefing before the wind, the *mizzen*-topsail is kept up to becalm the *main*.

PLATE 80.

Fig. 397.

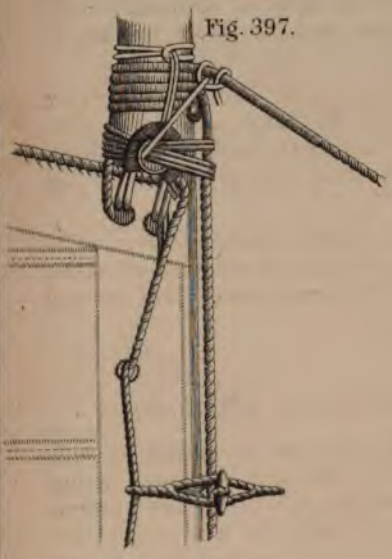

Fig. 398.

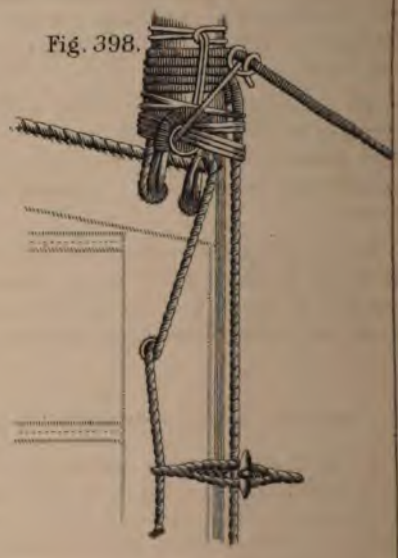

Fig. 399.

Fig. 400.

the sail (since if it were taken around the boom the sail could not be brailed up), putting canvas underneath to prevent chafe. Bring the forward cringle down to the tack, and reef the sail on the foot.

In reefing a *jib*, haul the sail down, and bring the forward cringle to the tack-hook in the boom—the after one to the clew, and pass the earings; then reef the sail on the foot with nettles—points are never used. A better way than this is to take off the *bonnet*.

In *hoisting sails* after reefing, be careful (particularly if it be blowing fresh) not to "swig" them up too taut, as the reef-bands are apt to be slewed under the yard in consequence, and the sail must necessarily be reefed afresh.

REEFING A SAIL FITTED WITH BECKETS AND BULL EARINGS.

As soon as the men are on the yard, the sail is picked up with both hands, until each man has hold of the reef line, then facing to leeward, light the sail out to windward. When the weather earing is passed, face to windward and light the sail over to leeward; when the lee earing is passed, toggle the reef-beckets and lay in.

To shake out a Reef. The reef-tackles are hauled well taut, and the halliards lowered a little. The reef-beckets are first untoggled, working from the slings towards the yard arms, and after they are all clear, the earings are eased down.

To pass the First and Second Reef-Earings. They are each rove with a long running eye round the yard arm (See EARINGS, page 197), passed from aft forward through the reef-cringles, and the sail hauled well up on top of the yard; then three turns round the yard up through the cringle, and the end hitched to the lift, Fig. 397, Plate 80.

If the first inner turn is taken round the yard without being passed through the cringle, the sail will keep up better, and the earing is passed much quicker, Fig. 398.

First and second reef-earings are sometimes fitted and passed in the same manner as the third and fourth, only with fewer turns.

To pass the Third and Fourth Reef-Earings. A turn is taken round the yard arm, before the lift, over the cleats, and through the reef-cringle from aft, forward. The sail is hauled well up on top of the yard, then three or four turns passed round the yard and up through the cringle. The end, after taking a turn round

the yard arm, is hitched to the lift. If the first inner turn is passed round the yard arm only, it will keep up better, Fig. 399.

For smartness, earings are frequently passed on the bight.

A strap round the yard arm, with a large thimble covered with hide, is sometimes used, and the outer turns of the earings are passed the same as a head earing. Fig. 400.

REEFING A BOOM MAINSAIL.

The earing of a boom mainsail consists of a long pendant, having a Matthew-Walker knot hove in one end. Reeve the pointed end *up* through an eye-bolt on one side of the boom—through the reef-cringle in the leech of the sail, and down the opposite side through a sheave on the side of the boom, immediately opposite the eye-bolt. Clap a jigger on this end, and having settled down the halliards, haul away and get the cringle close down to the boom; belay the fall, and placing parcelling around sail and boom, pass a good lashing or earing. Pass the tack lashing, and tie away the points around the foot of the sail.

REMARKS ON REEFING TOPSAILS.

If sailing with the squadron in moderate breezes, run the yards in nearly square, else the men will lose time in getting on the weather yard arm.

It is considered neat to hand the upper sails while reefing, letting fall as the topsails are hoisted; at least, the top-gallant sheets should be hauled taut after lowering their halliards to correspond with the reef. When double or treble reefing on a wind with courses set, on account of weather, bear in mind that the outer arms of the topsail yards are unsupported, and are unequal to the strain that may be injudiciously brought to bear on them, by overmanning the reef-tackle on deck. When the yard is laid, the duty of the reef-tackle is to give the earing men plenty of slack leech between itself and yard; and if it cannot effect this without much straining (and this can easily be judged of by observing the tautness of the leeches *below* the reef-tackles on each side) raise the clews at once with the clewlines, sufficiently for the purpose.

Pull the buntlines well up so as to girt the sail in for the bunt points.

Nothing is gained by permitting the men to get out on the yard for reefing, in a strong breeze, until the yard is laid and

the sail ready for them. Yard arms have been wrung off in the endeavor to make the reef-tackle do all the duty of other gear, and the earing men's lives saved only by a seeming chance.

In reefing at night, in the line, observe if your second ahead and astern have more or less sail than topsails. If you have been sparing them courses, you will be run into; and if they have been sparing them to you, you will run into your leader, unless you are alert.

After every evolution (especially at night), make the petty officers report their ropes, and also immediately after relieving the watch. A few fathoms of the main brace, checked by one hand, will often just regulate the pace and keep the ship in station; and, if let go at the instant, arrest danger.*

In *turning out reefs*, let go the bowlines, and settle a sufficiency of the halliards to counteract the effect of the lee leech on the weather brace, which must be rounded in enough to enable the men to get at the lee points, unless beckets are used. If with a treble-reef, check the lee lower braces, set taut the reef-tackles and buntlines, cast off the points from the slings, out, observing to see the earings down together, when every point in the band is disengaged.

When all reefs are out, it will often be necessary, in bracing sharp up, to check the weather topsail halliards; and the lower yards will pivot all the livelier, the closer the quarter blocks and leads of topsail sheets are to the slings.

Preventer brace pendants, made long enough to reach from the yard arm to the top, are not only quickly attached to the whips, but the risk sometimes incurred in sending men on the yards greatly diminished. Preventer topsail braces have more drift, and a more downward pull than the standing ones; and, therefore, should never be so taut, or be hauled upon, until the lifts are well up.

The general rule for topsail lift jiggers, is to put them on when the second reefs are taken in. And it is good to make a habit of putting the spare parrels and preventer braces on when the third are taken in.

When top-gallant yards are sent down on account of weather, unreeve the top-gallant sheets, and reeve them through the bowline bridle of the topsails, up before all, and hitch them to the

* This refers to sailing in line. Hardly too much can be said of the many and great advantages of squadron sailing; the constant rivalry excited among the several ships, making it one of the very highest schools of seamanship.

lugs of the tie blocks. They will be found to act even better than leechlines of courses when taking in topsails.

From their greater length, the sail tackles are generally used for preventer lower, and the topmast studding-sail halliards for the preventer topsail braces.

REEFING TOPSAILS AND COURSES.

Haul up the courses, lower the topsails, and round all the weather braces in to touching; the reef-burtons and reef-tackles will now haul out easily. Haul taut the topsail halliards, lee braces, lifts, and rolling-tackles, and haul the topsail buntlines well up out of the way of the men on the lower yards. If a becketed topsail, the fourth reef-earing hauls out before the yard, as the others; with pointed topsails, that earing is passed abaft the yard.

With four reefs in the topsails, it is always good to keep the sheets eased off some four feet; they may be hauled up thus far when the reef tackle is being hauled out. It is recommended to get the topsail up while lifting, easing braces and rolling tackles to liking, bearing in mind, that as the lee forward topmast shrouds should not be too much pressed by the lee quarters of the topsail yards, there is no good object gained in bracing lower yards quite up. Under such sail as this, there is generally much motion, and the chafe in the nips of the stays, as well as in the wake of sharp-up yards, is beyond the power of protection from any description of service or scotchmen.

A head sail should always be set, and great care should be observed while taking in reefs, that the ship is not taken aback. Moving the yards for the purpose of trimming sails, or indeed for any purpose, when the men are on them, is most perilous; for the foot of the topsails will sweep the lower yards, and the lower yards themselves will be, for a time, quite adrift.

These evolutions (*reefing topsails and courses*) are sometimes performed at the same time, but when there is much motion, it is considered more ship-shape to defer reefing the courses until the topsails are reefed and reset. By so doing, the ship is kept more steady while the people are aloft, and under much better command.

Lower yards should be well placed before sending men on them for the purpose of reefing or furling courses. When it becomes necessary to perform either of these operations at sea, there is generally considerable motion; and an attempt to remedy neglect

or want of judgment in this particular, by handling the braces while men are on the yards, is always attended with great danger to them, especially in the case of main yard men, who are mostly composed of inexperienced hands, for the yards, on becoming released from the nip of the stays, lee rigging and trusses, will not only "sally" from side to side, but scend violently fore and aft.

CHAPTER XXVIII.

SQUALLS—THE LAWS OF STORMS—THE BAROMETER.

SQUALLS.

THE only question of importance involved in the whole subject of an officer's conduct in charge of a ship during a squall, when by the wind, is, *must he luff*, or *must he keep her away?* If the daily practice of the merchant service be any criterion; if the opinions of skilful seamen may be considered as having any weight in the matter; and lastly, if the declarations of reason and common sense affect the question in the smallest degree, a ship should not, as a general rule, be kept off in a squall when sailing close-hauled to the wind. In the first place, the natural tendency of the vessel is to luff of herself, when careening under her canvas, and so great indeed is this disposition, that it requires a powerful effort of the helm to counteract it.

This may be shown by an exceedingly simple diagram, Fig. 406, Plate 82, where, it will be seen, that when the vessel heels to either side, the shape of her displacement is entirely changed, and consequently the *resistance* upon the bow unequally divided—that to leeward being greater than its opposite, in the ratio of the ship's inclination. Under these circumstances, it is manifest that the ship will be forced in the direction of the dotted line x, or, in other words, *luff* of her own accord, and without any action of the helm whatever; while at the same time she approaches the wind, which loses its effect upon her sails. Again, if the ship be kept away, sail cannot be shortened until the wind is abaft the beam, to reach which, she must pass some point where its whole force will be exerted to overset her. But independent of this consideration, a ship loses ground by running off, and there are often circumstances which render it both impolitic and unsafe to do so.

The argument employed by the opponents of the *practice* of luffing, is the liability to get aback, and the consequent danger to be incurred by making a stern-board. In luffing to a squall, however, let it be done with a steady helm, and be quick to meet the ship when she "trembles." And here arises a point in trimming the yards in squally weather, to which it is perhaps well to recur, viz., the after yards should *always* be trimmed "fine," or,

THE LAWS OF STORMS.

in other words, braced in sufficiently to touch their sails when luffing, while at the same time the head yards stand *full*.

Lastly, *never trust a squall which cannot be seen through*, for when a heavy squall strikes the ship, you can seldom reduce sail without losing it.

BY THE WIND UNDER ALL SAIL, TO REDUCE SAIL TO A SQUALL.

Take in the royals, flying-jib, mainsail, and spanker. Take in top-gallant sails, clew down the topsails, haul out the reef-tackles, haul up the buntlines, and belay the topsail clewlines. Set fore topmast staysail and haul down the jib. Receive the squall under this sail. Have a hand by the fore sheet.

If the squall comes so heavy as to endanger your going over, let fly the lee topsail sheets; clew up mizzen topsail, up helm, ease off fore sheet to relieve the pressure under the lee bow, and run before the wind. Clew up fore and main topsails, and haul up foresail.

Haul by the wind and make sail after the squall has passed.

If by the wind under topsails and foresail you are struck by a squall, clew down the topsails, *luffing to touch the leeches*. The helm must be carefully attended.

If by the wind, *with mainsail set*, you are suddenly struck by a heavy squall, hard up the helm, take in sail, *letting go* sheets and halliards, if absolutely necessary, hauling up lee clewlines first.

If running free, proceed in same manner.

THE LAWS OF STORMS.

Alston, in his excellent work on Seamanship, puts the following supposititious cases, and imparts some valuable information on the subject of gales which the young officers are recommended to read with care.

1st. One of the junior officers of a brig-of-war, cruising in the Mozambique, is put in charge of a large slaver captured off Quilimane, and leaves for the Cape on the 12th of February, 18--. A four days' run places her in latitude 27° S., longitude 40° E., when the weather becomes unsettled, and an easterly swell is noticed. On the afternoon of the 16th, the wind chops round to the S. E., and the ship is brought to the wind on the port tack. The sun sets wild and fiery, hollow gusts come up and rapidly succeed each other as the day wears on, until 8 P. M., when the ship heels over to a steady freshening breeze from the

southward, and a reef is taken in the topsails. The officer goes below, and glancing at the barometer, sees no cause for apprehension in the not very extraordinary fall from 29.98 at noon, when it was last taken, to 27.70 in the subsequent eight hours. The wind continues much the same during the night, until 6 A. M., of the 17th, when it draws ahead a little, and at 10 A. M., having made about W. S. W. 80 miles, they tack. At 4 P. M., the breeze having freshened considerably, the topsails are double-reefed, the wind being S. by W.; and before 10 P. M., close reefs are taken in, courses and mizzen topsail furled, it then blowing a gale from the S. S. W. with a heavy cross sea. The barometer is referred to, and found to have fallen half an inch (to 29.15); on which the fore topsail is with difficulty taken in, and all made as snug as possible. At midnight, the wind is round to S. W., blowing a terrific gale, and the barometer rapidly falling. Shortly afterwards, the main topsail is blown to ribbons, and an attempt is made to "lay her to" under tarpaulins in the main rigging, it being impossible to show any canvas to it. The wind by this time is round to W. S. W. About two hours afterwards, the main topmast goes by the cap, and the mizzen mast a few feet above the deck; the fore topmast is then cut away to save the foremast, the starboard bower anchor cut adrift, and a whole cable veered to endeavor to keep her head to wind. The ship labors on, making a great deal of water, till near four in the morning, it then blowing a hurricane from the westward, when she is thrown on her beam ends, the sea making a clean breach over her, and but for a solitary survivor picked up on a spar, nothing more would have been known of the fate of the lost ship, but that which is contained in the mournful, but alas! too common epitaph—"Foundered at sea!"

Point out the error committed, and state what you would have done had you been placed in a similar position.

2d. As a further illustration of this subject, we will suppose the following case:—

A new 16-gun brig, just launched at Bombay, sails for England on the 1st of June, 18—, in charge of a lieutenant from the commodore's ship, with the necessary subordinate officers, and forty men; and after a tedious passage down the coast, against a strong S. W. monsoon, arrives in latitude 6° N., longitude 77° E., at noon on the 20th; the monsoon then blowing from the westward, and the course steered E. S. E.

During the day, they ran into a northerly breeze, and the course was altered to S. E., it being their intention to cross the line about the meridian of 86°. At 3 A. M., 21st, the wind logged was N. N. E., 6, *q. u. r.*, barometer 29.90 (the barometer at mid-

night having stood at 30.01), the brig bowling along under port topmast studding-sails, which they are reluctantly obliged to take in at 6 A. M (bar. 29.78.) At 9 A. M., barometer had fallen to 29.64; and, anticipating a gale, the mainsail was furled, top-gallant mast sent on deck, and three reefs taken in the topsails, which they had reason to congratulate themselves on having done, for scarcely had they completed these precautionary measures at 11 A. M., when the gale *overtook them*, as they considered (bar. 29.38), and before noon, sail was reduced to close-reefed main topsail and reefed foresail, under which they hoped to run out of it, flattering themselves in the meantime that, while flying before the gale, they were making up their course a good fourteen knots an hour. (Bar. at noon, 29.00.)

By 1 P. M., the wind had drawn forward a point (N. E. by N.), blowing a furious gale, and they were at last compelled to round to under the main topsail and fore staysail, getting their decks swept in the operation, and the pinnace stove in on the booms; and, being unable to furl the foresail, the men were called down, and it was allowed to blow away. The log then is as follows:—

"2 P. M., blowing a storm (bar: 29.84), weather main topsail sheet went, and the sail with it, on which the storm main trysail was loosed and set. 3 P. M., wind N. E., blowing a most terrific hurricane, and ship in great danger; stationed hands for cutting away masts. About three quarters of an hour afterward, taken aback by a shift of wind; the brig went over and lay with her yard arms in the water, at which awful moment, Mr. ——, midshipman, and five seamen, were washed overboard. By great exertions, Lieutenant —— and several men succeeded in securing themselves on the weather broadside and in cutting away some of the weather rigging, when the masts and bowsprit went by the board, and her majesty's sloop righted with seven feet of water in the hold."

During the night she nearly foundered, and three more men were swept away while heaving the guns overboard; but by the morning, the weather having moderated considerably, and veered to the southward, they were enabled to set about rigging a jury-foremast, and a jiggermast abaft, under which, having picked up the monsoon again, they arrived, without further incident, in Trincomalee harbor.

State how this danger and loss of life might have been averted, and what principles are illustrated thereby.

The culpable disaster detailed in the first question resulted from disregard, or ignorance of the well-known laws of storms, which, had they been attended to, would not only have enabled you

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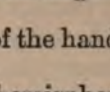
friend to avoid all danger from the approaching storm, but would have taught him how to profit by it, and unhesitatingly to turn it to his own advantage. There is space here only to touch on the first principles of this very attractive science; and, for its interesting particulars, the reader must refer to the standard works of Piddington and Reid.

But five and twenty years have elapsed since Mr. Redfield, of New York, first drew public attention to the rotatory and progressive motions of storms, which resulted in the discovery of the following laws:

1. That, in the northern hemisphere, their axial rotation is in a direction contrary to that of the hands of a watch, or W.  E.; and that, in the southern hemisphere, they rotate with the hands of a watch, or W. E.

2. That though some cyclones are almost stationary storms, the majority move onward, on a curved track, at a rate varying from one to ten miles an hour in the Southern ocean, or from ten to forty in the West Indies; that, near the equator, their course is nearly west, diverging to the north in north latitudes, and to the south in south latitudes, until they cross the tropics, when the curve becomes more rapid, and they finally recurve to the eastward. Their dimensions vary from two hundred to six hundred miles in diameter in the South Indian ocean, and from one hundred to one thousand miles in the Atlantic. The usual typhoons of the China sea are from sixty to three hundred miles in diameter.

3. That there is generally a calm space in the centre, where sudden and terrific gusts break the unnatural repose, with a confused and dangerous sea running.*

4. That in the northern hemisphere, the centre bears eight points to the left of the wind, your back being to it; and in the southern hemisphere, eight points to the right of the wind.†

5. That cyclones are almost always preceded by a falling barometer.‡

* In the hurricane that passed over Martinique, October 11, 1831, nine thousand people perished; and at St. Pierre the sea rose to a height of twenty-five feet, and one hundred and fifty houses along the beach disappeared in a moment.

† The course of a cyclone is considered like that of a river, the banks of which are named *right* and *left*, as they lie when looking towards its mouth; so looking to the quarter towards which the cyclone moves we find the bearing of its centre, and name its semicircles.

‡ In the hurricane at Havana, October 12, 1846, the fall of the barometer was so sudden, in the vortex, that the windows of the houses were forced *outward*.

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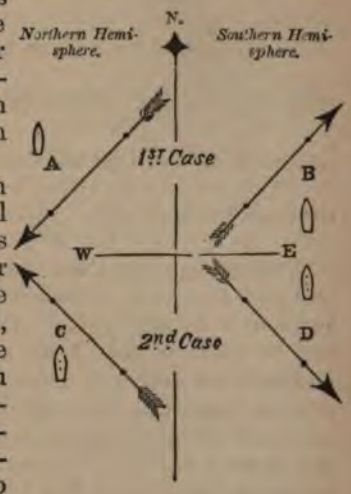
6. That, to avoid them, you should, when to the right of the cyclone's track, or in the right-hand semicircle, lie to on the starboard tack; and in the left-hand semicircle, or to the left of it, on the port tack, in both hemispheres. But this, as will subsequently be seen, only holds good when you are far enough from its path to be out of harm's reach, for it then insures you against closing within dangerous limits, and from being taken aback from the shifts of wind, which, if this rule is attended to, will always be aft. When before, or near its track, it is necessary to increase your distance by bearing up or standing off, as the case may be, until the cyclone has passed, when you may resume your course with caution.*



By projecting the track of a storm by the bearing of the centre, it will be seen—firstly, that when the shifts of wind in either hemisphere occur in the direction N. E. S. W., you are in the right-hand semicircle; and, secondly, when the wind veers in the contrary direction N. W. S. E., you are in the left-hand semicircle. Consequently, in the first case (see diagram), in north latitudes, the cyclone is travelling from eastward to westward, and in south latitudes from westward to eastward.

In the second case (see diagram), in north latitudes, its course is from eastward to westward, and in south latitudes, from westward to eastward.

In Diagram A, the ship.....	at first has wind North,	when Centre would be	East.
	afterward	East.....	South.
In Diagram B,	at first.....	North.....	West.
	afterward.....	East.....	North.
In Diagram C,	at first.....	North.....	East.
	afterward	West.....	North.
In Diagram D,	at first.....	North	West.
	afterward	West.....	South.

It will be observed that the wind is here spoken of as changing in a direction contrary to that of the storms themselves,

* In the memorable gale after Rodney's action, of the 1st of April, 1782, upward of three thousand seamen alone are computed to have perished in the fleet and convoy. *The ships were hove to on the wrong tack.*—REID.

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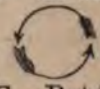
which in north latitudes has been stated to be W. E., and in south latitudes, W. E.; for, in the first case given above, the shifts of wind are assumed to occur in the direction W. E.; and, in the second case in the direction W. E. In the first case this is contrary to the rotary motion of northerly storms, and in the second case, contrary to that of southerly storms.

The reason of this will be seen, if we draw a circle N. W. S. E., to represent the body of a storm, with a ship anywhere within its influence, as at A. Assuming the ship to be in north latitude, the cyclone will be revolving in the direction shown by the curved arrows, and the wind in each quarter of the storm circle will blow in the direction shown by the straight arrows; for, though it sweeps *round* the storm's axis, it may, from the small segment occupied by a ship, be represented, as far as she is concerned, as a tangent to the circle.

At A, therefore, she will have the wind from the eastward, and the centre of the storm will be eight points to the left, or south of her. If it is travelling from east to west, the first shift of wind she will experience will be from the S. E.; for, while moving on its course in the direction C, C¹, it will be changing the bearing of its centre from the ship, which, when at C¹, will be S. W. of her, with the wind from the S. E. So that, though the storm is revolving in the direction W.  E., the wind is shifting in direction of W. E. But if the ship, on the contrary, be in the other semicircle, say at B, she would have the wind at west, and when the centre reached C¹, at S. W.; consequently, the change being from west to S. W., would *coincide* with the rotary motion of the storm.

The figure will also show why, if induced to cross the path of a hurricane with a fair wind, you will be deceived by finding it coming round against you as you enter the other semicircle.

Now, if we apply these principles to the case in point it will be seen that at 8 P. M., the 16th, the prize got the first hurricane-wind, the true nature of which might have been conjectured from the atmospheric appearances, the fall of the barometer, the easterly swell (cyclones in these latitudes usually travelling from the E. N. E.) and from the time of the year (the month of February being that in which the greatest number of hurricanes occur in those latitudes). However, at this early stage, to have failed in interpreting these signs is very pardonable: and the reason that nothing further occurred during the night was owing to her steering a course in advance of that of the storm. At 6 A. M., 17th, however, it was gaining on the ship, which brings the wind further forward: and, on tacking, and finding the wind increasing and veering in the order to be expected, they should have been on the alert, have carefully watched the barometer, registering it every half-hour, and been prepared to escape from the anticipated danger, which would soon unmistakably have declared itself. At 7 or 8 P. M., at the very latest, they should have bore up north, and afterward N. N. E., or thereabouts, as the wind drew forward, and ran, until told by a rising barometer, a moderating gale, and the wind's direction, that the storm had passed. By noon, 18th, they would probably have run far enough, the wind being W. N. W., and it would have been safe to have hauled gradually round again, keeping away S. E. till the wind was N. W., which they would have got—say about 7 P. M., taking care not to draw too close upon the storm again, nor yet to get beyond its influence. They might then have braced forward on the starboard tack and resumed the voyage, parallel, but in the rear of the storm, with a fine, fresh breeze. Its track would probably have soon curved away rapidly to the southward, and carried them five or six hundred miles upon their course; and when their road and the storms no longer agreed, they might have parted company at their own discretion.

In the second case, had the subject of it, as late as 9 A. M., when their apprehensions were first awakened, shortened sail, brought to on the starboard tack, and made the necessary preparations for a heavy gale of wind, which they still would have had, they would have escaped uninjured. The centre of it would have approached as near to them as it subsequently was about 1 P. M.; and then, gradually receding, would have allowed them to proceed on their voyage. Instead of which, lured on by the prospects of a good run to the southward, and entertaining the erroneous idea that running before it was the most likely means of running

out of it, they hit upon the most direct method for running headlong into it, which they accordingly did, and, as we have seen, narrowly escaped with their dismasted ship.

This being an example of a cyclone in north latitudes, at 3 A. M., therefore, if the ship was within its influence, the centre must have borne E. S. E., or eight points to the left of the wind; consequently the course steered, S. E., tended to lead her directly for it, if, as was afterwards proved to be the case, the track of the cyclone, in conformity with their usual course in these latitudes, was to the westward; and the fallacy of running *from* it, as they supposed, is fully evident.

There having been little difference between the progressive motion of the storm and the speed of the ship, no considerable alteration in its bearing occurred until 1 P. M., when the wind, having come round to N. E. by N., showed the bearing of its centre to be S. E. by E. As they closed, these changes necessarily occurred more rapidly; and hence the danger, when on the wrong tack, of being taken aback, as they in this instance were.

In the morning, the wind having drawn round to the southward, showed that the storm had passed away to the westward, and that no further mischief was to be apprehended from this formidable meteor.

On the 21st October, 1858, the United States frigate "Sabine," being then in lat. 36° 37′ N., long. 66° 6′ W., encountered a terrific cyclone, a detailed account of which will be found in an interesting little brochure by Rear-Admiral Goldsborough. The following extract forms the conclusion of his remarks:

"We will now conclude this paper by pointing out, in a few words, how we think a vessel in the northern hemisphere ought to act in all cases while at large upon the ocean, when beset by a cyclone.

"Fortunately, cyclones give a combined warning of their presence, and it is by no means indistinct. It consists of a falling barometer; a threatening appearance of the weather; a heavy swell of the sea; and a wind increasing in violence. With these indications, occurring simultaneously, one may feel sufficiently assured that he is in contact with the storm, and that it is high time for him to direct his course to avert its danger. The first thing, however, to be done, is to ascertain carefully how the wind

veers, or whether it veer at all; and perhaps the better way tc do this would be to exercise the patience of bringing the ship by the wind on the *starboard* tack in the northern hemisphere, and deadening her way as much as possible so as not to confound the apparent direction of the wind which any headway on her part would create, with that of its true. Thus the object in view, in a gyratory wind, could soon be satisfactorily accomplished—say in one hour at most. Then—

"*In the event of finding the wind not to veer at all*, run the ship off at once with the wind very well aft on the *starboard* quarter, and continue on this *same compass course*, no matter how the wind may happen to change.

"*In the event of finding the wind to veer to the left or to back*, run the ship off at once with the wind on the *starboard* quarter, and continue on this *same compass course*, no matter how the wind may happen to change.

"*In the event of finding the wind to veer to the right or to haul*, keep the ship by the wind, or a little free, on the *starboard* tack, and continue her by the wind, or a little free, however the wind may change.

"In case the wind, in this instance, should be found to veer but *very slowly* to the right, and thus indicate that the ship, although in the right-hand semicircle, was yet very near the track of the storm, it would be preferable, under such circumstances, to run her off in the way mentioned above in the case of finding the wind not to veer at all, instead of hauling by the wind on the starboard tack, for then the left-hand or less dangerous semicircle might be gained without incurring any risk.

"In each of the above cases it would be proper to keep the ship as intimated respectively, until the barometer began to rise from where it was on starting, and the wind to cease in violence, and then to keep her with the wind abeam, or on the quarter, on the starboard tack, whichever might be preferred with reference to the prevailing sea, or the place to which she was bound. No great while, however, would elapse before the ship would be at liberty to pursue whatever course she pleased.

"In the northern hemisphere the *port tack* should never be resorted to from choice, in any form or way, except in the solitary case of the ship being in such a position in the *left-hand* semicircle, and at such a distance from the storm's track, as to incur no risk whatever of being brought within the dangerous influence of its vortex. Then, to *bow* the sea, and to avoid being taken aback by the *backing* wind, it may be greatly preferable.

WIND AND WEATHER.

"In the *southern* hemisphere, however, the port tack, as a general thing, is just as preferable to the starboard as the latter is to it in the northern hemisphere. There the wind of a cyclone whirls exactly in an opposite sense to what it does in this. Keeping in view the fact of this opposition in whirling motion, the management of a ship in the southern hemisphere, in a cyclone, should be conducted precisely with reference to the same principles of procedure as one in this. There, of course, it is the left-hand semicircle, and not the right, that contains the stronger winds."

In that greatest of naval disasters on record—the loss of Rodney's prizes, referred to in note, page 503—had the fleet adopted the policy suggested above, i. e., run off with the wind abaft the starboard beam, or to the northward, the wind being at first E. S. E., the dangerous portion of the cyclone would have been avoided. They should then have hove to on the port tack, being in the left-hand semicircle. It is to be regretted that the little work referred to has not found more general circulation

WIND AND WEATHER.

"Some persons attribute influence to the moon in respect of weather, and say a change may be expected within a few days of the moon's phases. But the interval between one and another phase of the moon is but seven days, and 'a few' of these days *must* be a time near one phase or another. Accidental coincidences are generally allowed to influence the wind, because, when they occur, they mark any event more particularly. Similar to these are the prejudices against sailing on Friday, which used to be so general."

Continued comparisons of changes of weather or wind during many consecutive years, in various parts of the world, have proved decidedly that there is no regular correspondence between the lunar phases and atmospherical changes.

The following are a few of the more marked signs of weather:—

"Weather, clear or cloudy, a rosy sky at sunset presages fine weather; a red sky in the morning, bad weather, or much wind (if not rain); a gray sky in the morning, fine weather; a high dawn, wind; a low dawn, fair weather."

[A high dawn is when the first streaks of morning light appear over a bank of cloud, instead of near the horizon, as is usual when there are no heavy clouds.]

"Soft-looking, or delicate clouds, foretell fine weather, with moderate or light breezes; hard edged, oily-looking clouds, wind. A dark, gloomy blue sky is windy; but a light, bright blue sky

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indicates fine weather. Generally, the *softer* clouds look, the less wind (but perhaps more rain) may be expected; and the harder, more 'greasy,' rolled, tufted, or ragged, the stronger the coming wind will prove. Also a bright yellow sky at sunset presages wind; a pale yellow, wet; and thus, by the prevalence of red, yellow, or gray tints, the coming weather may be foretold very nearly; indeed, if aided by instruments, almost exactly.

"Small inky-clouds foretell rain; a light scud, driving across heavy clouds, wind and rain; but if alone, wind only.

"High upper clouds crossing the sun, moon, or stars, in a direction different from that of the lower clouds or wind then blowing, foretell a change of wind (beyond tropical latitudes).

"After fine, clear weather, the first signs (in the sky) of change, are usually small, curly, streaked, or spotty clouds, followed by an overcasting of vapor that grows into cloudiness. This murky appearance, more or less oily or watery, as wind or rain will prevail, is a sure sign. The higher and more distant the clouds seem to be, the more gradual, but extensive, the coming change of weather will prove.

"Generally speaking, natural, quiet, delicate tints or colors, with soft, undefined forms of clouds, foretell fine weather; but gaudy, or unusual hues, with hard, definite outlines, presage rain and wind."

THE USE OF THE BAROMETER.

"By attention to the following observations (the result of many years' practice, and many persons' experience), any one not accustomed to use a barometer, may do so without hesitation or real difficulty.

"In all parts of the world, towards the higher latitudes, the quicksilver ranges, or rises and falls, nearly three inches, namely, between about thirty inches and eight tenths (30.8), and less than twenty-eight inches (28.0) on extraordinary occasions; but the usual range is from about 30.5 inches, to about 29 inches. Near the line, or in equatoral places, the range is but a few tenths, except in storms, when it sometimes falls to 27 inches.

"If the barometer has been about its ordinary height, say near thirty inches, at the sea level,* and is steady, or rising, while the

* In different latitudes the ordinary, mean, or normal height may be less, or even more than 30 inches, though *seldom* the latter, except from the tropics to about the thirty-fifth parallel. It stands lower, about a tenth of an inch for each hundred feet of height directly upwards, or vertically, above the sea; when its average height, on the Thames, in England, is 29.94 inches (at 32°).

thermometer falls, and dampness becomes less,* northwesterly, northerly, or northeasterly wind, or less wind may be expected.†

"On the contrary, if a fall takes place, with a rising thermometer and increased dampness, the wind and rain (or snow) may be expected from the southeastward, southward, or southwestward.

"Exceptions to these rules occur when a northeasterly wind, with wet (rain or snow), is impending, before which the barometer often rises (on account of the *direction* of the coming wind alone), and deceives persons who, from that sign only (its rising), expect fair weather.

"When the barometer is rather below its ordinary height, say near twenty-nine inches and a half (at the sea level *only*), a rise foretells less wind, or a change in its direction toward the northward, or less wet; but when the mercury has been low, say near twenty-nine inches, the first rising usually precedes, and foretells strong wind (at times heavy squalls) from the northwestward, northward, or northeastward, *after* which violence a rising glass foretells improving weather, if the thermometer falls. But if the warmth continue, probably the wind will back (shift against the sun's course), and more southerly, or southwesterly wind will follow.

"The most dangerous shifts of wind, and the heaviest northerly‡ gales happen after the mercury first rises from a very low point.

"It may be repeated that indications of approaching changes of weather, and the direction and force of winds, are shown less by the

* If a thermometer have a piece of linen tied around the bulb, wetted enough to keep it damp, by a thread or wick dipping into a cup of water, it will show less heat than a dry one, in proportion to the dryness of the air and quickness of drying. In very damp weather, with or *before* rain, fog, or dew, two such thermometers will be nearly alike.

Hence, for ascertaining the dryness or moisture of air, a ready and sure method is the comparison of two thermometers, one dry, the other *just* moistened and *kept so*. Cooled by evaporation, as much as the state of the air admits, the moist (or wet) bulb thermometer shows a temperature nearly equal to that of the other one, when the atmosphere is extremely damp or moist; but lower at other times, in proportion to the dryness of air, and consequent evaporation, as far as twelve or fifteen degrees in England, twenty, or even more, elsewhere. About six degrees difference is considered healthy in a temperate climate.

Pouring water over the bulb, instead of merely moistening it, imparts to the mercury the temperature of the water, which *may* be higher than that of the air.

† In the southern hemisphere, for North read South, and for South put North, in these pages.

‡ Southerly, in south latitudes. The movements are the same with east and west winds in both hemispheres; but if there be a rise in an instrument with a north wind in the northern hemisphere, it sinks with a north wind in the southern, and *vice versa*. The same occurs with south winds.

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height of mercury in the tube, then by its falling or rising. Also that a height of about thirty inches or upwards (at the level of the sea), is indicative of fine weather and moderate winds.

"A rapid rise of the barometer indicates unsettled weather. A slow rise, or steadiness, with dryness, shows fair weather.

"A considerable and rapid fall is a sign of stormy weather and rain. Alternate rising and sinking show very unsettled weather.

"The greatest depressions of the barometer are with gales from the S. E., southward, or S. W.; the greatest elevations, with winds from the N. W., northward, or N. E.

"Although the barometer generally falls with a southerly, and rises with a northerly wind, the contrary *sometimes* occurs; in which cases the southerly wind is dry and the weather fine, or the northerly wind is wet and violent.

"When the barometer sinks considerably, high wind, rain, or snow, will follow. The wind will be from the northward if the thermometer is low (for the season); from the southward, if the thermometer is high for the time of year and the locality.

"Sudden falls of the barometer, with a westerly wind, are sometimes followed by violent storms from N. W. or north.

"If a gale sets in from the eastward or S. E., and the wind veers by the south, the barometer will continue falling until the wind becomes S. W., when a comparative lull may occur; after which the gale will be renewed; and the shifting of the wind towards the N. W. will be indicated by a fall of the thermometer, as well as a rise of the barometer.

"As a general rule, the wind usually veers, shifts or goes round, *with the sun* (right-handed in northern places, left-handed in the southern parts of the world), and when it does not do so, or backs, more wind or bad weather may be expected, instead of improvement.

"This veering of the winds is a direct consequence of the earth's rotation, and currents of air from the polar regions alternating or contending with others from the equator. The polar currents are cold, dry, and heavy. Those from the equatorial parts of the world are warm, moist, and comparatively light. Their alternate or combined action (*foretold* by the glasses and other signs), solar heat, and electricity, cause all the varieties of weather that we experience.

"In a barometer the mercury begins to rise occasionally before the conclusion of a gale, sometimes even at its commencement, as the equilibrium of the atmosphere begins to be restored.

PROVERBS AMONG SEAMEN.

Although the mercury falls lowest before high winds, it frequently sinks considerably before heavy rain. The barometer falls, but *not always*, on the approach of thunder and lightning, or when the atmosphere is highly charged with electricity. Before and during the earlier or middle part of severe and settled weather, the mercury commonly stands high, and is stationary.

"Instances of fine weather, with a low glass, occur exceptionally; but they are always preludes to a duration of wind or rain, *if not both.*

"There may be heavy rains or violent winds beyond the horizon, and the view of an observer, by which his instruments may be affected considerably, although no particular change of weather occurs in his immediate locality.

"The caution already given should be specially remembered, that the longer a change of wind or weather is foretold by the barometer before it takes place, the longer the presaged weather will last; and, conversely, the shorter the warning, the less time, whatever causes the warning, whether wind, or fall of rain or snow, will continue.

"The tides are affected by atmospheric pressure, so much that a rise of one inch in the barometer will have a corresponding fall in the tides of nine to sixteen inches, or say one foot for each inch.

"Vessels sometimes enter docks, or even harbors, where they have scarcely a foot of water more than their draught; and as docking, as well as launching large ships, requires a close calculation of height of water, the state of the barometer becomes of additional importance on such occasions."

PROVERBS COMMON AMONG SEAMEN.

"A red sky in the morning,
Sailors take warning;
A red sky at night
Is a sailor's delight."

"The evening red and morning gray
Are sure signs of a fine day;
But the evening gray and morning red
Make the sailor shake his head."

"With the rain before the wind,
Your topsail halliards you must mind;
But when the wind's before the rain,
You may hoist your topsails up again."

"Long foretold, long last,
Short notice, soon past.

RECORD OF WEATHER.

"First rise, after very low,
Indicates a stronger blow.

"When the sun sets in a clear,
An easterly wind you need not fear.

"He who strives the tempest to disarm,
Must never first embrail the lee yard-arm."

RELATING TO THE HURRICANE MONTHS IN THE WEST INDIES.

June, too soon;
July, stand by;
August, look out you must;
September, remember;
October, all over.

RECORD OF WEATHER.

In keeping the Journal, for the sake of brevity, the force of the wind and state of the weather are expressed thus:

WINDS.

0. Calm.
1. Light air; just perceptible.
2. Light breeze; ship going from one to two knots.
3. Gentle breeze, from two to four.
4. Moderate; from four to six.
5. Fresh; when royals can be carried.
6. Strong breeze; first reef and topgallant sails.
7. Moderate gale; double reefed topsails.
8. Fresh gales; treble reefed topsails and reefed courses.
9. Strong gale; close reefs.
10. Whole gale; close reefed main topsail.
11. Storm; storm staysails.
12. Hurricane; no canvas.

WEATHER.

b. Blue sky.
c. Cloudy.
d. Drizzling rain.
f. Foggy.
g. Gloomy weather.
h. Hail.
l. Lightning.
m. Misty.
o. Overcast.
p. Passing showers.
q. Squalls.
r. Rainy.
s. Snow.
t. Thunder.
u. Ugly threatening weather
v. Visibility of objects.
w. Wet dew.

A star (*) under any letter denotes a great degree.

"Cirrus" expresses a cloud, like a lock of hair, consisting of streaks, wisps, and fibres, vulgarly called "mares' tails." "Cumulus," a cloud in dense convex heaps in rounded forms definitely terminated above, indicating saturation in the region of air, and a rising supply of vapor from below. "Stratus" is a continuous

extended level sheet, but must must not be confounded wit
flat base of the Cumulus. "Cumulo-stratus," or anvil-sh
cloud, is said to forerun heavy gales. "Nimbus," a dense
spreading out into a crown of "Cirrus" above, and passing
neath into a shower.

These symbols and terms are used in all our log-books.

TABLE SHOWING THE FORCE AND VELOCITY OF THE WIND.

BY SIR W. SNOW HARRIS.

Pressure in lbs. per square foot.	Velocity in miles per hour.	Popular Descriptions, and Corresponding Numbers.	Pressure in lbs. per square foot.	Velocity in miles per hour.	Popular Descriptions, and Corresponding Numbers.
0.002	0.68	1.	1.042	15	6.
0.004	1	Gentle airs, unappreciable by gauge	1.170	16	Fresh breezes; top-gallant sails.
0.005	1.06		1.250	16.5	
		2.	1.302	17	7.
0.019	2	Light airs, just appreciable by gauge; would fill the lightest sail of a yacht.	1.430	17.8	Fresh winds; reefs.
0.028	2.5		1.470	18	
0.032	2.66		1.563	18.67	8.
0.043	3		1.630	19	Strong winds; treble reefed topsails.
			1.790	20	
0.052	3.3				9.
0.065	3.8		1.820	20.14	Gales; close-r'fed topsails and r'fed courses.
0.071	4		2.084	21.47	
0.090	4.5	3.	2.600	24	
0.100	4.75	Light breezes, such as would fill the lightest sails of a large ship.	3.126	26.40	10.
0.112	5		3.647	28.52	Str'ng gales; close r'fed topsails, and staysails.
0.130	5.38		4.168	30.56	
0.136	5.5		4.689	32.34	
0.162	6		5 200	34	11.
0.228	7		7.800	41	Heavy gales and storms.
0.260	7.6		10.400	48.2	
0.291	8		13.000	53.91	
0.364	9	4.	15.600	59	
0.390	9.27	Moderate breezes, in which ships can carry all sail.	20.800	68.18	12.
0.452	10		26.000	76.18	Very heavy gales; great storms, tempests.
0.521	10.77		31.200	83.6	
0.551	11				
0.650	12		36.400	90.12	Tornadoes; cyclones; hurricanes.
0.780	13	5.	41 600	90.34	
0.830	13.6	Fresh breezes; top-gallant sails and royals.			
0.884	14		52.000	107.7	
0.910	14.25		62.400	120	

CHAPTER XXIX.

IN A GALE—SCUDDING—LYING TO, ETC.

LET the wind be supposed to be increasing gradually, the topsails to be single-reefed, and the top-gallant sails furled; proceed then

TO REEF THE SPANKER.

Settle down the throat and peak, pass the earing and tack lashing, and tie the points under the foot, after which sway the sail up to a taut leech.

TO TAKE IN THE JIB AND SET FORE TOPMAST STAYSAIL.

Man the jib downhaul! Topmast staysail halliards! Clear away the downhaul! Hoist away! Clear away the halliards! Haul down!

The jib sheet should be eased off as the sail comes down. In setting the staysail, first haul aft the sheet, and then ease it off as the sail goes up. To take in and stow a jib when blowing hard, it is always better to run the ship off if possible.

THE WIND FRESHENS, TO TAKE A SECOND REEF IN THE TOPSAILS.

Proceed as in taking in the first reef, and put jiggers on the topsail lifts, and haul them taut.

TO REEF COURSES.

Man the fore and main clew-garnets and buntlines! Haul taut! Up courses! haul the clew-garnets about two thirds up. *Haul out the reef-tackles!* See the lifts and braces well taut. *Aloft lower yard-men! Trice up! Lay out! and reef!*

The reef-earings are passed on the end, out over the yard-arm, back through the cringle, &c., &c., as with a topsail.

The sail being reefed—

Lay in! Down booms! Lay down from aloft! Man the tacks and sheets, and set the sails. If the yard is to be braced in to clear the sail of the stays, do so before the men lay out.

IN A GALE.

TO TAKE THE THIRD REEF IN THE TOPSAILS.

Proceed as before, observing not to brace the topsail or lower yards too sharp up. Now get the preventer braces and parrels (if fitted) on. Get rolling ropes on the top-gallant yards, if still aloft, and hook the rolling tackles.*

TO HAUL UP AND FURL THE MAINSAIL.

Man the main clew-garnets and buntlines! the weather clew-garnet, both buntlines and leech-lines are manned. Before starting anything, haul taut the lee main lift, and ease off a fathom or two of the main sheet. *Ease away the main tack and bowline! Haul up to windward!*

The lee buntline is hauled up as far as it will go.

When the weather clew is up, *Ease away the main sheet, haul up to leeward!* Run up all the gear, send the men aloft and furl the sail, keeping the ship as near the wind as possible, and not sending the men on the yard until it is secured and sail hauled close up.

TO SEND DOWN ROYAL YARDS.

The officer of the deck commands, *Get the royal yards ready for coming down!* At this order the royal yard-men lay aloft and unbend royal gear, stop the yard rope out to leeward, bend the tripping-line to the snorter to windward, and send it down to windward and abaft everything; the topmen on deck take off the royal halliards and lead along the yard rope. *Man the yard ropes and tripping-lines! Tend the braces!* when manned, *Stand by—Sway!* The yard is swayed up and down, and yard-arms unrigged as it comes down; the men in the top pulling up on the lee lift and letting go the weather one when the order is given to sway.

The yards being on deck, are secured in the gangways or on the booms, yard ropes rounded up, &c., &c.

SENDING DOWN TOP-GALLANT YARDS.

Get the top-gallant yards ready for coming down!

The top-gallant yard men lay aloft, unreeve top-gallant studding-sail halliards, unbend top-gallant gear, &c., &c., as with the

* With patent trusses on the lower, and jaws on topsail and top-gallant yards, rolling tackles are scarcely needed.

royal yards. Proceed as with royal yards, sending them down to windward and abaft.

TO CLOSE REEF THE TOPSAILS.

Proceed to clew down and lay the yards as in reefing (Chapter XXVII.). Haul the reef-tackles well out, to do which, ease off the sheets or brace in the lower yards. Lay out and reef as before, except that in this case the earings are passed from aft, forward, and the *after* legs of the reef-points hauled well up when "tying away." Sway the yard clear of the cap and trim it.

NOTE. In hauling out the reef-tackles, preparatory to close reefing, haul up on the clewlines when easing off the sheet, particularly in cold weather when they may not *render* readily; otherwise, the *leech* may be torn out of the sail.

TO TAKE THE SECOND REEF IN THE FORESAIL.

Haul it up as described, taking in the mainsail, and reef as before. The sail being reefed, set it as already explained.

To set fore-storm staysail, and haul down fore topmast staysail, proceed as in taking in jib and setting fore topmast staysail.

TAKE IN AND FURL MIZZEN TOPSAIL. (GALE.)

See Chapter XXIII.

TO SET THE MAIN TRYSAIL. (GALE.)

The officer of the deck commands, *Clear away the main trysail!* The sheet is then got aft and hooked, and sail loosed. The peak outhaul and sheet being manned, and a hand by the weather vang; *Clear away the downhaul! Haul out!* easing off the weather vang; when the out haul is out, *Haul aft the sheet!* Steady the vang.

To reef the main trysail, use the burton for peak halliards (if fitted with a span), lower the gaff sufficiently, and proceed as in reefing the spanker.

TO TAKE IN THE FORE TOPSAIL. (GALE.)

See Chapter XXIII.

IN A GALE.

TO HAUL UP AND FURL THE FORESAIL.

Take the sail in as in "taking in the mainsail." Secure the yard and furl the sail. The ship is now "*lying to*" under close-reefed main topsail, single-reefed main trysail, and fore storm-staysail. Hook the main topsail clew-jiggers, and haul taut main topsail reef-tackles.

PREPARATIONS FOR A GALE.

Get up and hook pendant-tackles, rolling-tackles, and preventer braces (if not already on); mats on bunt of sails and quarters of yards; yards pointed to the wind, and secured and hoisted clear of the caps; anchors, boats, and guns, well secured; life-lines fore and aft all the decks; spare spars and yards on deck well lashed, as also everything movable on deck and below. Have hatches ready for battening down; spare axes at hand; pumps clear; storm staysails and gear overhauled and ready; relieving tackles ready for hooking; spare tiller at hand; also compasses.

If expecting a hurricane, get the jib and flying-jib booms in; also whiskers and dolphin striker; send down top-gallant masts and rigging; studding-sails out of tops; all shot below out of racks; pass a hawser round the laniards of lower rigging; cook provisions in advance; furl all square sails; set the fore storm-staysail and have the others ready; marl the sails down to the yards with the studding-sail gear, in addition to the gaskets, &c., &c.

SEND DOWN TOP-GALLANT MASTS.

The studding-sail gear being unrove and blocks sent down from mast heads; flying-jib halliards unrove, and top-gallant and royal yard ropes; mast ropes rove, &c., &c., have hands by the back-stays, shrouds, and fore-and-aft stays; bend on a heel rope and send it down. *Man the mast ropes and heel ropes! Sway up.* and take out the fids, carefully attending the fore-and-aft stays, and *Lower away!* When the royal sheave hole comes below the cap, pass the lizard (double mast rope). Lower the mast on deck, forward of the topsail yards, they being braced in. The topmen aloft unclamp the forward side of tressle-trees as the mast goes down. The funnel is lashed aloft, as also the royal rigging. Stop in the shrouds to the topmast rigging; sheep-shank the back-stays, and take down the slack of the fore-and-aft stays; stop in all rigging, and finally lash the top-gallant masts in the gang-ways.

SCUDDING.

NOTE. It is not recommended to send down top-gallant masts in a gale, although such was, and, to some extent, still is, the practice in foreign navies. When sending them down at sea, under *whole topsails*, it is better to lower the topsail yards at once, and send the masts down forward, than to attempt sending them down abaft. In the case of sending them down with the close-reefed main topsail set, fore and mizzen furled, send the main down *abaft* the topsail yard.

TO SEND UP TOP-GALLANT MASTS.

Man the top-gallant mast ropes! If the topsail yards can be *braced in*, send the masts up forward; otherwise abaft. Men aloft have the royal rigging, &c., ready for going over the mast head; hands with jiggers by stays and backstays, &c., &c. When ready, *Sway aloft!* Cast off the lizard as soon as the royal mast-head is between the tressle-trees; place the truck, royal rigging, and top-gallant rigging. When the fid is in, *Launch!* Stay the masts and set up the rigging.

TO RIG IN THE FLYING-JIB BOOM.

Reeve the heel-rope; bend on a rope's end from the forecastle, and hook the fore clew-jigger to a strap round the boom near the heel, to assist in rousing it in. Have slip ropes round the jib and flying-jib booms. The flying-jib must be unbent. Come up the rigging. Rig in, unreeve fore-royal and flying-jib stays, and take off guys, foot-ropes, and martingale. Secure the boom in the gangway, and stop in all rigging.

TO SCUD.

In a preceding paragraph, the proper arrangement of sail has been given for lying to in a gale, but should the wind be favorable, and the sea not running too high, as it will not unless the gale has been of long continuance, a vessel may *scud* before it, under such sail as the force of the wind will allow. In sailing with the wind aft, it is greatly disarmed of its force, and a vessel may carry safely some sail, when, if on the wind, she would be reduced to bare poles.

The best sails for scudding (or *running)* under, are, a close-reefed main topsail, and single or double-reefed foresail; and a gale is rarely of such violence that this sail cannot be carried safely. The former, by its height, will not be becalmed by the waves, while the latter may be necessary, in case of being

SCUDDING.

brought by the lee, to pay her off to her course. The fore topmast staysail should always be set in scudding, or the fore storm staysail sheets hauled flat aft.

Vessels sometimes steer wildly in scudding, in consequence of being out of trim, of their bad qualities, or the force of the sea on either quarter, in which cases, or by the negligence of the helmsman, she may, in yawing, bring her sails aback. She is then "*brought by the lee*," or "*has broached to.*" The proper manner of recovering her we will endeavor to explain, as follows:

Brought by the Lee. Suppose, in scudding, with the wind a little on the port quarter, under the sail as above, you are brought by the lee, and have everything aback.

The wind is now on the starboard beam, *Put the helm hard to starboard!* until headway ceases, when shift it. Man the port braces fore and aft. *Rise fore tack and sheet! Clear away the head bo'lines! Brace full the head yards!* and shiver the after ones. Attend the lifts and rolling-tackles, as in former evolutions. She will pay off under this arrangement, the helm itself partly effecting it before she loses headway.

When before the wind, right the helm and trim the yards for the course. Haul taut the rolling tackles, lifts, &c.

Broaching to. In case of having *broached to*, and brought the wind on, or forward of, the port beam, meet her with the helm and lee braces, by putting the helm hard a-port, and hauling in the starboard head braces.

You may, by altering the trim of a vessel, shifting some heavy articles, as guns, shot, or chain cables, forward or aft, ease the helm greatly, and make her steer less wildly, which is certainly advisable; for the danger of being brought by the lee or broaching to, is, that of shipping a heavy sea, which will sweep the decks, losing some of the masts or yards; and should she gather rapid sternboard before being recovered, of foundering.

REMARKS ON SCUDDING.

There is a point beyond which no vessel can scud without the greatest possible danger. Of course much will depend on the size and height of the vessel out of the water, but there is scarcely ever heard a dissenting voice as to flush vessels being by far the most dangerous while scudding in heavy weather. You should bring your ship to the wind while it can be effected without the greatest risk to ship and lives. If night is coming on, and the weather has every appearance of an increasing gale,

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with a falling barometer, and circumstances will admit, it would be advisable to lay the ship by the wind; and as every gale may be supposed to partake of the nature of a cyclone, taking care to select, if optional, that tack which will drift you away from its centre, or *on which the wind draws aft.* In scudding, the tiller ropes are constantly doing double duty; and though the relieving tackles are hooked, you cannot steer the ship with that nicety that you can with the wheel. Should the tiller ropes unfortunately be carried away, the risk of broaching the ship to is then considerably augmented; and if to this you add the increased difficulty of the management of a ship on a dark night, and a heavy gale of wind—with all these things considered, there can be no doubt that it would be right to bring a ship to the wind previous to night setting in, when you are doubtful about the effect scudding may have on the ship. Sometimes, unavoidably, in scudding, you are obliged to carry your fore topsail and foresail; when that happens, it may arise from some accident received to the spars or rigging on the centre masts, in which case it is generally considered advisable by good seamen to make the fore topsail and foresail rather rising sails, by easing off the sheets until they have that tendency. Of course, when all things are right on the mainmast, the main topsail and foresail are the best sails for scudding under, while the ship will carry them. It is generally considered best that the foresail should rather raise the bow than have the contrary effect, more particularly in sharp vessels.

TO BRING BY THE WIND, AND LIE TO IN A GALE.

After scudding for any length of time, the increased violence of the gale and force of the sea causing the vessel to labor greatly, straining her in every part; or having approached some land which, from the state of the weather, you are unable to distinguish, it may be necessary to bring by the wind, and lie to until the gale abates. We will, for example, bring to on the port tack.

Have the storm staysails ready, sheets hooked and moused, secure everything about the decks and below. Send everybody on deck. Put on and batten down the hatches. Man the fore clew-garnets and buntlines, starboard fore, and main and port-jack braces, main and mizzen staysail halliards. Watch for a smooth time. Haul up the foresail, put the helm to starboard, brace up the after yards, and hoist the mizzen staysail or storm-mizzen. As she comes to, hoist the main staysail, and meet her by the helm, the head braces, and by hoisting the fore staysail. Then haul taut the rolling tackles and lifts. It may be

LYING TO.

necessary to furl the main topsail, and she may lie to better without the fore storm staysail. After she has recovered from the first shock of the sea, and has lost her headway, she will, with the helm a-lee, and under a proper arrangement of the sails, lie to, coming up and falling off two or three points, and drifting bodily to leeward.

When a vessel labors much in a seaway, either lying to or standing on her course, the sails should never be hoisted up, or the braces hauled, as taut as in a smooth sea; for the play of the masts will either carry away the braces and sheets or spring the yards. And if the pitching is hard and quick, you should see that the helm is eased, allowing it to go to leeward, so that she may obey freely the sea, the shock of which will be less violent against the rudder.

And after the gale abates, sail *should not be made* upon the vessel *too rapidly*, particularly if her course will bring the sea ahead or forward of the beam. You should be content with giving her headway until the sea also abates; for, by forcing her through a head sea, you strain every mast and yard, and injure the rigging.

Preventer braces, shrouds, and backstays, are used in heavy weather, as a relief to the standing ones; these are of great importance to the mizzen topmast, the standing part of the main topsail brace leading from its head nearly at right angles, while the angle formed by the backstay is too small to afford a sufficient support.

RUDDER, WHEEL-ROPES, RELIEVING-TACKLES, ETC.

The rudder, wheel-ropes, and relieving-tackles, should occupy the particular attention of the first lieutenant and navigator. The former, with its tiller, are permanent fixtures, so arranged, and of such durable materials, that they will withstand the severest shocks. Wheel-ropes are liable to chafes, and should be occasionally examined by the navigator. Those of raw hide, now in common use, are found to be exceedingly serviceable and durable; they should be occasionally oiled, and protected from chafe.

Relieving-tackles should be kept fitted, and constantly at hand, and, in a gale of wind, with a heavy sea, when the parting of a wheel-rope might endanger the vessel, should be kept hooked, and hands stationed, by them under the direction of an officer.

LYING TO.

Cases have occurred, in which rudders have been unshipped or otherwise injured, so as to be of no further use, when it has been necessary to resort to some expedient to manage the vessel.

Vessels can always be better managed when by the wind, than in any other situation. They will sometimes steer themselves for hours, having their yards so trimmed and their sails so regulated as to keep by the wind. Care must be taken that the vessel holds a good wind, and at the same time does not *gripe*. By slacking, on the one hand, a few feet of the head sheets, and on the other of the spanker and main sheet, an equilibrium will be established between the head and after sails.

The moment you lose your rudder, bring her up by the after sails, bracing the yards, and meet her, as she comes to, with the head sails. Then, by reducing the sails forward or aft, and bracing the yards, you may steer her, until you can resort to better means, as follows:

TO STEER BY A CABLE.

Rouse up from below a hemp cable and hawser; middle and clove-hitch the hawser, and veer the end of the cable over the taffrail, through this hitch; after veering out about fifty fathoms of cable, jamb the hitch and rack it well, securing it so that it cannot slip. Then veer out the cable until the hitch takes the water. Lash the cable on the centre of the taffrail, and a spare spar under it and across the stern, with a block well secured at each end, through which reeve the ends of the hawser, one on each quarter. Reeve them again through blocks at the ports, abreast of the capstan, by which you may steer your ship until you can construct a temporary rudder.

By rousing in the hawser on either quarter, the force of the sea on the cable, drawn over on that quarter, moves her stern the opposite way.

USING A DRAG IN A GALE.

The method of steering by a hawser or cable may be resorted to in other emergencies besides that of losing a rudder. It is related by an officer of great experience, that having been caught in a hurricane, in the Florida channel, in one of our small vessels, it was found that she steered so wildly as to be in constant danger of broaching to. It soon became evident if something was not done the brig would certainly be lost. The largest hawser on board was therefore got up and paid out over the stern for a con-

siderable distance in her wake, which, in effect, exceeded the most sanguine expectations. It acted as a *drag*, seeming to break the force of the sea, and steadying the little vessel so as to render "broaching to" impossible. The severity of the gale may be understood when it is known that a Spanish frigate foundered at her anchors in the Havana, and three merchantmen went down in sight of the brig.

LYING TO UNDER CLOSE REEFED MAIN TOPSAIL, REEFED MAIN TRYSAIL, AND FORE STORM STAYSAIL, YOU ARE KNOCKED DOWN.

Hard up! Let go main trysail sheet and peak outhaul! Main topsail clewlines! Let go the sheets! Clew up! If you have time to clear away the fore topmast staysail, or foresail, hoist away the first and haul aboard the fore tack, but if not, and the ship does not go off, *Man the weather fore rigging!* Send as many men aloft as can stand there, and she will probably fall off.

A SHIP ON HER BEAM ENDS.

If thrown on your beam ends at any time, under any circumstances, let fly everything. If she does not right, cut away the masts (which in this case will be accomplished by cutting the weather laniards of the lower rigging). Cut the lashings of the spare spars and boats if possible, as well as everything else on deck which will float.

If on soundings, cutting away an anchor (chain bent), will bring her head to wind, and perhaps right her.

TO RIDE OUT A GALE UNDER THE LEE OF A SPANNED SPAR.

Liardet says: It is astonishing that so few attempts have yet been made by seamen generally, to save their vessels by riding out gales under the lee of spars. We continually hear of boats being saved by these means; and if a ship get on her beam ends, stop-waters are advised to be veered from her quarter to get her before the wind by the best professional writers, and seamen generally. But let a vessel have her sails blown away; let her be partially dismasted, or even wholly so; rolling about in the trough of the sea, tearing herself to pieces, unmanageable, and washing everything away; still you seldom hear of the same resources being tried to ride the ship by, so frequently is this most desirable object neglected, when it is so evidently of importance to her ease and safety. The stream cable, or one of the strongest hawsers, bent on to the wreck, or to any part of the

SEA ANCHOR.

wreck previous to cutting it away, would make a capital sea-anchor; however, should you not be able to make a hawser fast to the wreck, it takes very little to keep a ship head to wind; a few spars from the booms, a quarter, or stern boat might be so slung, as when sunk, to ride the ship well; even a small anchor and cable veered to about fifty or sixty fathoms, would be found most useful; whatever you put over the bows will tend to make the sea strike the ship in a better position for her safety. The less resistance a ship makes against the sea the better for her safety; consequently, the exposure of the whole broadside to the trough of the sea must be the most dangerous situation a ship can possibly be placed in. The next most dangerous position must be that of the sea striking her stern, this part being much weaker than the bows, and not shaped like the latter for throwing off the sea. We are strongly of opinion that if more attention were paid to having a stop-water of some kind from the head of the ship to make her ride head to wind, when from the loss of masts, rudder, sail, or derangement of engine, you cannot keep the ship out of the trough of the sea, it would tend to lessen the number of those melancholy shipwrecks that we so generally read of.

For description of a sea anchor, see ANCHORS (page 279).

PREPARATIONS FOR ROUNDING CAPE HORN.

When a boisterous passage is anticipated, as in "rounding the Horn," for instance, it is customary to make certain preparations, such as bending a new suit of sails, reeving new braces, tacks, and sheets, &c., striking some of the guns below, and passing shot with them. (See Ordnance Regulations on the subject.) Securing the forward guns amidships on main deck, and housing the others; caulking in the forward main deck ports, strengthening the fastenings of the bridle and bow ports; fitting leech lines to topsails, getting the stern boats in board; and making the usual preparations for bad weather as already given. Stump top-gallants are frequently sent up in place of the pole top-gallant masts.

CHAPTER XXX.

PARTING RIGGING.

REMARKS ON WEATHER BRACES BEING CARRIED AWAY.

WHEN this occurs, it is generally at the first burst of a squall, on a wind, nearly all the reefs out, and consequently, when there are no preventer braces or parrels on the yard; for, as the wind strengthens to stiff double-reefed topsail increasing breezes, all prudent seamen take the precaution of clapping on these additional supports. When a weather brace carries away, there being no preventer, the yard immediately becomes a lever; the stay, or parrel, or truss, being the fulcrum; the lee rigging, the weight; and the wind, the power.

The remedy will depend on the amount of power. If it be small, a new brace is rove, or the old one is repaired with a long splice.

In substituting new running rigging for old, when the run of the lead is not lost, the ends are spliced, or stopped together; and, as one is run off, the other enters its place; otherwise, men must be sent aloft to reeve the gear.

When the power is great, the yard or parrel will be the next thing to go; for the yard flies fore and aft, and even the mast as well as the yard is in such instant danger that the remedy must be quick as the order. The lee sheet must be eased off roundly, lee clewline and buntline hauled up. The danger would be increased by bearing up before this were done, for as the wind came abeam, it would act with still greater force upon the sail. Both clewline or downhaul tackle and lee bowline should then be hauled on, and, if necessary, about two fathoms of the weather clew raised, so as to throw the wind more out of the sail. If these measures fail to start the yard, the sail must be clewed up altogether, the buntlines being well manned while doing so; and then the bowline and downhaul or clewlines will bring the yard down; when it may be steadied by lashings from the rigging while the damage is being repaired.

Or, after starting enough lee sheet to save the yard, the course may be hauled up, and the lower yard squared, lowering the topsail as it comes aback; setting the course again when the topsail yard is lashed. Should the ship not be in the line or on a lee

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shore, she may, if preferred, be kept away (after the lee clew is run up) until the yard is down and secured.

If it be a lower brace, lower the topsail, letting fly the lee sheet and hauling in the weather brace if needful. Ease off the sheet of the course, short of spilling the sail, let go the tack (for the first important duty is to save the yard), and clew up. One scend might break the brace, the next would break the yard; but there would be just time enough between the scends for a quick ready officer to start all the principal gear that would relieve the yard.

If this accident occurs forward, the weather helm must be attended to.

Accidents to the tack of a course, clew-garnets, &c., being carried away, may, when circumstances permit, be repaired by bearing up and hauling aft the sheet of the damaged side.

BY THE WIND, WEATHER MAIN BRACE PARTS.

Luff! Weather main clew-garnet! Let go the main tack, haul up! Weather topsail brace, topsail clewlines and buntlines! Clear away the main-top bo'line! Settle away the topsail halliards, brace aback! Ease off the main sheet! Haul out the reef-tackles, haul up the buntlines! Haul forward the lee main-top bo'line! Easing away the lee main brace, and hauling up the lee main clew-garnet. This, by throwing the main topsail aback, would steady the main yard sufficiently to allow hands to lay out with whips for the preventer braces. If the brace has not unrove through the block on the yard, a hand may secure the end to its own part, so that it may be hauled taut on deck.

Should it be blowing too hard to risk backing the main topsail, take in mainsail, clew down main topsail, and haul up the weather clew. Haul the lee reef tackle well taut, and lee main top bowline.

When a brace parts, the yard is first in danger and then the mast; therefore it is necessary to relieve the yard of the sails immediately.

BY THE WIND, WEATHER MAIN TOPSAIL BRACE PARTS.

Luff! Flow the head sheets! Weather main brace! Main clew-garnets and buntlines! Up mainsail! Brace aback! Settle away the topsail halliards! Clew down! Haul out the reef tackles, haul up the buntlines! Square the main yard, and haul

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taut the lee main-top bowline. The ship is now "hove to," with the main topsail to the mast. If the yard binds in clewing down, ease off the lee sheet.

If not possible to get the topsail aback, clew down and haul up the weather clew-line.

With the wind quartering, if the weather main-topsail brace goes, *Hard up!* brace in, up mainsail (lee clew), and clew down as before, easing off lee main-topsail sheet as necessary.

WEATHER REEF TACKLE CARRIED AWAY.

This occurs generally while reefing, in consequence of undue strain produced by want of skill in not placing the yard so that the wind will nearly be thrown out of the sail. The men should be ordered in off the yard instantly; the weather clewline, and as much as can be got of the buntlines hauled up, and enough of the sheet clewed up to admit of bracing the weather arm aback or nearly so; the men may then venture out, and pass a sea-gasket working from the arm inward, until the reef-cringle is reached, when the tackle can be rove afresh. Starting gear with men on the yards is one of those fearful blunders which always inspire topmen with such distrust of the officer who commits them, that they never work well aloft in his watch on deck.

WEATHER TOPSAIL SHEET AND CLEWLINE CARRIED AWAY.

When this happens on a wind, the clew flies forward and may be steadied by the bowline, but as the yard might be sprung on the weather quarter from the upward pressure of the sail, it should immediately be relieved by checking a couple of fathoms of the lee sheet. The lee clew, buntlines, reef tackles must then be hauled up, the yard lowered and squared, the bowline being eased away as the sail comes aback; when so it will lie quiet, and the bowline may be sent with a hauling line from the foretop into the main, rove before the sail through a leading block on the topmast, and the leech thus hauled in along the yard, so that the sail may be handed if needful, and new gear rove; an attempt to "hand the leech in" before lowering, clewing up and squaring, would not only be useless but dangerous.

If the course is not set, check lee sheet as above, round in weather lower and topsail braces, lower and throw the sail aback, easing away the bowline.

PARTING RIGGING.

MAIN TACK AND CLEW-GARNET GONE.

Check main sheet to ease the yard, for the same reason given in taking in a course. The danger of the sail being split will depend much on the position of the mainstay. In many ships it would bring the tack up, so that the tack could be steadied by the weather sheet, and a new rope rove; if not, the topsail would have to be clewed up, and then the course, the main yard squared, and the weather sheet gathered in same time, or, circumstances permitting, bear up and haul weather sheet aft.

TOPSAIL BRACE AND PARREL CARRIED AWAY.

This rarely happens where the security of the parrels, tacks, and sheet fastenings, and all that gear which is likely to be handled while exercising, are made matters of special report.

In a strong breeze on a wind, when the yard is nipped so hard by the lee rigging and stay that it cannot be got down by the clewlines or downhaul, after clewing the sail up, send the end of a hawser up abaft the top to the topmast head; pass it round both tyes, and make it fast to the after lower cap-bolt. Haul down on the hawser, easing away the halliards until the yard is on the cap; clap on the new parrel; lash the yard by the quarters to the topmast rigging, and then repair the braces.

When this accident occurs under low sail, the yard would fly so far forward as to suggest considerable danger to it and the mast from the force with which the yard would fly aft, if the sail were thrown aback by squaring the main yard. This latter mode is, however, recommended by some of the best seamen, who, having tried it successfully, are best able to judge of its merits.

If the wind is aft, clew up, hoist the yard close up to the gin-blocks and haul the lifts taut. This will keep it steady until the hawser is passed round the tyes.

TOP-GALLANT BRACE AND PARREL CARRIED AWAY.

In this case, where sending men to the mast-head is out of the question, and clewlines have failed, there is every chance of losing the mast if you hold on, and of the clews getting round the stay if you let go the sheets. The lower and topsail yard must be braced by, and the ship, if necessary, sufficiently touched with the helm, to throw the top-gallant sail slightly aback.

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BOBSTAYS GONE.

Not having been able to realize an instance, we can only submit what seems to be the best remedy.

As this accident would probably occur while pitching heavily, the greatest activity should be displayed in letting go every rope that drags the head of the foremast aft and securing that spar with tackles; if clear of the land, the helm is put hard up, spanker taken in, after sails spilt, the main yard being worked with the after braces, main topsail lowered, the stay slackened; chain stream cable run out of a main or middle deck port from well abaft the foremast; passed over the bowsprit outside the rigging, and through the corresponding port on the opposite side; the runners passed through the adjoining ports, their pendants across the stem, over the cable on the opposite side, back up through the port and secured inboard. The cable might be lashed meanwhile at the bowsprit, so as to make the bight a fixture; pull up the runners, easing the cable down until both parts are nipped at the lower part of the head knee or cutwater.

When the spar is secure, anchor shackles, with a length of stream chain fast to them (also crossed), may then be put on each outer part of the bobstay, and, on these being hove down, the runners may be removed before being frayed and cut through.

It is customary to say that the proper thing to do in the case of broken bobstays, is "bear up and pass the messenger out of the hawse-holes, over the bowsprit and heave down;" but a glance over the bows will convince any learner that the support thus given would, even in a three-decker, be trifling, while in a frigate it would be nothing; moreover, the quantity of water shipped in the larger vessel, on opening her hawse-holes, would greatly inconvenience, if not endanger her safety. Bobstay collars, being fitted of iron, are not liable to accidents.

TOPMAST-STAY CARRIED AWAY.

Keep the ship away, shorten sail, overhaul down, hook and haul taut the top-burton, and replace the stay with a hawser, bowline knotted round the mast-head.

JIB-SHEET CARRIED AWAY.

Mind your weather helm! haul down the jib; ease off the spanker sheet, and clear away and hoist the fore topmast staysail.

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TILLER-ROPE CARRIED AWAY.

When this occurs, it may be assumed to be blowing fresh. The first thing to be done, therefore, is to steady the rudder, which, in a seaway, would fly from side to side with great violence. The quickest way of doing so will be by means of the remaining rope; and, as the chances are that the weather wheel-rope will be the one to go, jamb the helm down, shorten sail, and heave to with the head yards abox, if you do not want to come round. Otherwise, if there is a ship close astern of you, for instance, haul the mainsail up, and square the main yard in stays. Should the lee rope go, put the helm up, heave to on the other tack, and shorten sail as soon as possible. If unsafe, from the position of the ship, to do either, man the head-sheets and cross-jack braces, and steer the ship by the sails. In moderate weather, the relieving-tackles will probably be hooked before it will be necessary to touch anything. In all cases, send hands down to hook and work them, and reeve new wheel-ropes.

The senior class of midshipmen on board the practice ships are recommended to prepare themselves for working ship without the assistance of the helm.

LOWER SHROUD CARRIED AWAY, AND NOT LONG ENOUGH FOR TURNING IN AFRESH.

Turn the dead eye out, strap it with a rope of equivalent dimensions, and seize a large thimble in; knot the shroud, reeve it through the thimble, and seize the end up; reeve the laniard again, and set the shroud up.

JIB-DOWNHAUL CARRIED AWAY.

Unbend the top-gallant bowlines, knot them together between the stay and the halliards and haul down. Or send the downhaul up by the weather bowline used as a hauling-line, bend it round the stay, and assist it, if the lacing jambs, by hauling down six feet at a time with a rope's end rove through the lee bowline block at the boom-end.

BY THE WIND, TOPSAIL PARREL CARRIES AWAY.

Luff to, man the weather braces, and brace the sail aback; haul up the mainsail; clew down the topsail yard and hook a tackle to the rolling-tackle straps on each side from the top, to

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steady it. See that the braces bear an equal strain. Fit a temporary parrel with a pair of slings and make sail again.

Clew up the sail if thought necessary; otherwise, haul out the reef-tackles and up the buntlines.

If the mizzen topsail parrel goes, the ship must be *luffed* so as to catch the sail aback before touching the lee braces. Let a hand take aloft a pair of barrel slings, and passing the bight round the tie, toggle both parts abaft the mast; shove the bight down over the tie-block (if there is one on the yard), and lower the sail.

If before the wind, haul taut the topsail lifts; clew up the sail if blowing fresh, and hoist the yard chock up. Either fit a temporary parrel, as with the mizzen topsail, before lowering; or, if in a large ship, send a hawser up abaft the top, to windward, to the topmast head; pass it round both ties and secure it to the after bolt on the lee side of the lower cap as already described. Snatch it as far aft as possible, and walk away with it as the halliards are lowered. Lash the yard to the topmast rigging.

In a case of this kind, the officer of the deck must first relieve the yard with the means at his *immediate* command, such as bracing aback or clewing up; afterwards, the safety of the yard will depend upon the activity of the watch in getting up other appliances.

In sending a hawser up as described, by overhauling down a whip from the topmast head (topmast studding-sail halliards, or lower studding-sail halliards, for instance), and bending on to the hawser in the hold, the whole work can be done in a very few minutes. Spars are lost too often by the time lost in considering "what's best to be done." One of the *essentials* in seamanship is to be *always ready*.

LOWER OR TOPSAIL LIFT PARTS.

Overhaul down the burton, and hook it to the burton-strap. Haul taut and reeve new lift. Topsail lifts are only hauled taut after the second or third reefs.

THE TRUSSES ARE CARRIED AWAY.

Say the main—take in mainsail and main topsail. Hook and haul taut the rolling-tackles; send aloft the end of a hawser, take several turns round the mast and slings and haul it taut. Fit new trusses and make sail.

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If by the wind, the main topsail may be clewed down and braced aback, hauling out the reef-tackles, &c., &c.

A couple of stout burtons from the mizzen pennants, hooked to straps on the main yard just outside of the truss-straps, would answer every purpose while fitting the new truss pennants.

NOTE. This accident (to *both* trusses) can hardly happen, unless before the wind, as otherwise the lee truss will be slack. The old-fashioned truss is here referred to, but the same remedy may be applied to a fracture of the new.

FUTTOCK BAND ON THE MAINMAST CARRIES AWAY.

This endangers the topmast, as the topmast shrouds have ceased to support it. Wear ship, if possible; if not, clew down the topsail; and if breast-backstays are carried, these, with the addition of the burtons, will support the mast while repairing the damage. If blowing hard, or if no breast-backstays are carried, send a hawser up to the mast-head, take the end round and pay down on deck. Clap luffs on both ends and set up; frap both parts of the hawser together below the cross-trees.

If unable to repair the band, either fit a rope one, or bring together all the futtock shrouds that require securing, shackle them to a spare anchor shackle, and set them up with a couple of pendant tackles hooked at the partners; then frap them into the mast aloft, wedging the frapping to tauten it, and cleating below to prevent slipping. Or if unable to frap aloft, hook the pendant tackles to bolts in the water-ways on opposite sides; the starboard one, for example, being hooked in the port waterways.

In either case the pendant tackles act as "Bentick shrouds." (See Darcy Lever's "Sheet Anchor.")

NOTE. In *all* cases of carrying away the weather standing rigging, go round on the other tack if possible.

LOWER STAY CARRIED AWAY.

Run before the wind, send aloft and hook the pendant tackles; hook them well forward and haul them taut. Use the stream cable, if hemp, in fitting new stays, otherwise a large hawser.

WEATHER LOWER SHROUDS CARRIED AWAY.

Wear ship, or take all sail off the mast. Then secure it with the pendant tackles and stream cable or largest hawser.

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THE GAMMONING IS CARRIED AWAY.

Run before the wind, haul down the head sails. Hook the fore pendant tackles and set them up well forward—say to straps round the cat-heads, or to the heavy ring-bolts generally placed near the knight-heads. Come up the head stays; bring the fore topmast and jib-stays in at the hawse-holes, and set them up. Set the main topmast stays up on deck, and house the main top-gallant mast. Send down the fore top-gallant mast, unbend head sails, and rig in the head booms.

Pass the end of the stream cable out of one hawse-hole, over the bowsprit, and in at the other. Put a heavy cleat on the bowsprit to prevent slipping. Belay one end of the stream cable to the bitts, and take the other to the capstan; heave it well taut, come up the old gammoning and pass a new one.

BOWSPRIT SHROUD CARRIED AWAY.

Go on the other tack if possible; if not, haul down the head sails, and keep away. Secure the bowsprit by hooking a stout tackle from the bows to a strap round the bowsprit, and fit a new shroud or splice the old one.

SLACK LOWER RIGGING AT SEA.

On changing suddenly from a cold to a hot climate, the rigging "gives out," sometimes to a dangerous extent. This is increased by the rolling motion; and casting it loose for the purpose of setting up, becomes a very critical operation, especially in bad weather, or when there is not enough wind to steady the ship.

Sometimes the stretching is due to an inferior quality of hemp. Whatever may be the reason, it is sometimes necessary to set up the lower rigging at sea. If by the wind, and nothing to prevent going about, set up the lee rigging; tack or wear ship, and set up the other side. If the mainstay requires a pull, it must be first set up.

It may be, however, that the vessel is rolling heavily and no wind to steady her. In this case, measure the distance from dead-eye to dead-eye, decide on the quantity necessary to take down on each shroud, and cut the measuring battens accordingly. Take one mast at a time and get up at least eight luffs—four of a side—and put them on the four forward shrouds. Hook four pendant tackles—two on each side; have selvagees, &c., ready;

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brace in the lower yard and furl all the sail on the mast on which you are at work. Send the top-gallant masts on deck.

Set up two shrouds (one pair) on each side at a time, keeping them adrift as short a time as possible. Shift the luffs from the first to the third pair of shrouds, while setting up the second pair.

Never come up *all* your lower rigging at sea, no matter how smooth the water nor how light the wind.

It is in such cases as setting up rigging in bad weather that the great value of the Rigging Screw (mentioned on page 107) is felt.

SCUDDING IN A HEAVY GALE—LOWER RIGGING VERY SLACK.

In this case it must be swiftered in. This is done by lashing a spar fore-and-aft outside the lower rigging, high enough up to insure the shrouds being clear of the nettings as much as possible, when pulled *inward*. Lash a single block round each shroud where the spar crosses, and let its lashing include the spar. Secure corresponding blocks on each side of the deck, as low down as may be; to a spar outside and lashings through the ports is safest. Reeve a hawser from each side of the deck through the blocks on its own side and those on the opposite rigging, and set all four ends up and secure them simultaneously.

THE SWIFTERING IN OF THE "MINNESOTA'S" LOWER RIGGING.

On the passage out to China, the "Minnesota" encountered a typhoon of unusual violence, in the Indian Ocean. For about eight hours it was not only impossible to carry sail, but the men could hardly be induced to show their heads above the rail.

The standing rigging, which was of Kentucky hemp, had always given much trouble by stretching; and the mainmast, which was stepped upon a *beam* over the shaft, had been evidently settling in its step.

These defects combined with the violence of the gale and rolling of the ship to render the position of the mast a very insecure one, and the officers finally became fearful, at every lee lurch, that the mast would go over the side.

The order was accordingly given to swifter in the weather main rigging. A piece of a broken topmast studding-sail boom was got up and lashed outside the rigging, about six feet above

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the rail. Another spar was placed outside the opposite spar-deck ports, and a heavy hawser pointed up from below, and the end taken alternately around the spar in the rigging and the spar outside the ports, until five or six turns had been taken, when each part was hove taut in succession, and frapped to the next one with selvagees.

On arriving in Hong-Kong, the dead-eyes were turned out, and the rigging refitted, when it was found that the main rigging had "stretched down" *two inches in circumference.**

* It would seem from this, that there was as much practical sense as humor in the wish expressed by a certain old boatswain, that if he was to be hung it might be with *Kentucky hemp*.

CHAPTER XXXI.

LOSING A FOREMAST, BOWSPRIT, ETC.

GENERAL REMARKS.

In case of losing a foremast, bowsprit, or any of the yards or masts, an officer must be guided entirely by the peculiar circumstances of the case. No rules can be laid down to govern him which may not be useless or superfluous in most cases that may occur. If he understands the principles of supporting masts, securing yards, and the effect of the sails upon the different parts of the vessel, then his judgment will, on the occurrence of any accident of this nature, point out to him instantly the readiest and best manner of proceeding.

If you lose your bowsprit, then all the masts forward lose the support of their stays, which want of support is carried aft to the main topmast, top-gallant mast, and thence to the mizzen; therefore, should you succeed in getting clear of the wreck, it will naturally occur to you to put the vessel before the wind, and bring all the support upon the backstays. To do which, it will be necessary to take in all the after sail.

But after having put her before the wind, in a heavy sea, and the vessel laboring, the masts are in danger from the want of support forward. Send down the top-gallant masts and house the fore topmast. Secure the foremast with hawsers or a stream cable, middled and clove-hitched around the mast head, and set up through the hawse-holes on the main deck. Clove-hitch, in like manner, a hawser around the topmast head, sway it up, and set up the hawser to the knight-heads. Then you may proceed to rig a jury bowsprit of the largest spar on board.

Or you may secure the foremast by pendant-tackles set up at the knight-heads; and the topmast by hawsers set up through the hawse-holes.

The head stays being secured by means of the bowsprit, one cannot well imagine the latter being carried away by any violent exertion, without also carrying away the fore topmast, and probably the foremast. In the latter case, the main topmast and all the top-gallant masts must go with it. If the foremast holds, the main topmast stays should immediately be brought down to the deck and set up, and a hawser taken up for an additional

security. A vessel in this situation, deprived of the force of all the head sails, will not be easily made to fall off before the wind, but on the contrary will have a great tendency to fly up; in which case, you may secure her to the wreck by stout moorings; then, having taken in all sail, and with a good scope out, ride under its lee until you can rig jury-masts and bowsprit.

Accidents of this nature are fortunately of rare occurrence in the navy, owing to the care with which our vessels-of-war are fitted out, and the very liberal allowance made for each in everything necessary to their equipment.

But it appears probable that they would be still more effectually prepared to resist the severest trials, if they were, in all cases, fitted out under the immediate supervision of the officer who is to command during the cruise, the first lieutenant who is to be the executive officer, and all the officers and crew who are to serve in them.

The good state of the rigging will not be the only advantage attendant upon this; a thorough knowledge of her state, and intimate acquaintance with her resources, would enable each and every one to bring them to bear when necessary.

Besides this, every officer should have experience in this part of his profession. It is one thing to perform the duties of a watch officer at sea, and quite a different thing to superintend the rigging or fitting out of a vessel. There are officers in the navy, of fifteen or twenty years' standing, who have been the greatest part of their time actively employed, but who have never been attached to a vessel when fitting out for sea, and have nothing more than a theoretical knowledge of the process in all its bearings. The reason is obvious, they have always been ordered to their vessels on the eve of sailing, and after having performed a cruise, have returned to enjoy a short respite from their duties; until another vessel, rigged and fitted out at some navy-yard, is ready for sea, and receives one of these officers, probably as her first lieutenant, entirely unacquainted with the state of her equipments.

But to resume the subject. Yards and masts may be, and occasionally are, carried away or sprung in a fresh breeze but smooth sea—top-gallant masts by not having their backstays well set up, and yards by not having their weather braces sufficiently taut when braced up. Topsail and top-gallant yards are also sometimes carried away by not letting go the lee brace in tacking ship, in a good swing of the after yards, when the lee brace not being properly attended to, neither the strength of the yard or brace can resist the force with which they are impelled;

LOSING MASTS, SPARS, ETC.

and if the brace holds, the yard must inevitably be carried away in the slings. Sometimes, also, a topsail, top-gallant or royal yard is sprung in being hoisted up too taut. But no explicit rule can be given for sending down broken spars. The first thing to be attended to is their being steadied and prevented from falling on deck or tearing the sails; the next is to sling, guy them clear, and get them on deck. If the screw is in motion, guard against fouling it by the wreck.

BOWSPRIT CARRIED AWAY OR SPRUNG.

If carried away, heave to under main topsail if not afraid of the strain on the foremast from the main topmast stays. Take all sail off the foremast and secure with pendant tackles and burtons. Send down fore top-gallant mast and set main topmast stays up on deck.

We may suppose that there is a gale blowing and a heavy sea on when a bowsprit is carried away. The ship must be hove to, otherwise the wreck forward would thump a hole in the bows. The wreck must be cleared away as soon as possible, and if a kedge, with a hawser bent to it, can be dropped on the wreck so as to *hang*, the ship might ride to leeward of it, under storm sails, and when the weather moderated save most of the wreck. Rig a jury bowsprit with the spare jib-boom or a topmast. Secure the fore topmast well and set fore topmast staysail on a stay to the jury bowsprit.

If the bowsprit is sprung, take all strain off of it. Fish the bowsprit and set up the stays again.

If very badly sprung, rig in the jib-boom until the heel rests against the stem. Place the flying-jib boom on one side and a topmast studding-sail boom on the other, and woold all together, wedging and chocking up between. Set up the head stays again, and make what sail the spar will bear.

LOWER MAST CARRIED AWAY OR SPRUNG.

Say the foremast is carried away. Secure the main topmast if it still stands, clewing up the main topsail; and house main and mizzen top-gallant masts, if still standing; the main top-gallant mast and main topmast, however, would probably go. Clear away the wreck and try to bring it in on the weather bow, and ride to leeward of it under storm staysails if possible. Cut the rigging clear of the head spars still standing.

If the main mast goes over the side, wear ship if possible, and bring it to windward.

LOSING MASTS, SPARS, ETC.

When a mast goes over the side, *first*, get clear of the wreck; *secondly*, secure spars still standing, and then think about rigging jury masts. If a foremast is sprung, say near the hounds, take all sail off the mast, reeve the top pendants, send down fore top-gallant mast, secure main topmast, and hook the fore jeers. Lower the fore yard and house the topmast until the heel comes below the defect; hang the heel in a chain from the tressle-trees; fish the mast with side fishes, and woold round all. Wedge well the woolding; turn in the topmast rigging afresh and set it up. Sway the fore yard up as high as it will go. Set the foresail and fore topsail with as many reefs as necessary.

If sprung lower down, first take in all sail set on the mast, and relieve it from all the strain possible; and then fish it with the fishes allowed. Iron bands are fitted at our yards large enough to take the mast and fishes. They open with a hinge, and can be quickly put on, in case of a mast being badly wounded in action, for example.

TO RIG A JURY FOREMAST.

Take the main topmast, rest its heel against the stump of the foremast, and launch its head over the knight-heads. Put on the cross-trees and bolsters; fit the rigging and stays from hawsers, or what is saved of the old rigging. Lash the heel to the stump, and cleat on either side sufficiently to prevent slipping while raising. Hook a couple of tackles to the jury-mast head and take them to the sides. Raise the mast with a tackle hooked well aft, and the main pendant-tackles. When up, lash the heel to the stump, and put heavy cleats before and on either side of it. Set up the rigging and head stays. Send aloft the cap and top-gallant mast, fit a topsail yard for a lower one; a top-gallant for a topsail yard, and bend main topsail and top-gallant sail for foresail and fore topsail.

MAIN TOPMAST CARRIED AWAY.

Reeve a couple of hawsers through the top-block; secure the mizzen top-gallant and royal mast; up mainsail if set: bend the lee hawser to the wreck to leeward; cut the topsail yard clear if possible and send it down, first clewing up the topsail. Send the wreck down, assisting with the main pendant-tackles and lee fore topsail halliards. Cut the laniards of the stays and rigging at once, if necessary.

Send the stump down with the weather hawser, and proceed to send aloft a new topmast.

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If a topmast is sprung, lower it as in the case of a sprung lower-mast, until the defective part comes below the lower tressle-trees, then woold as there described.

If sprung near the head, it can be fished with the top-gallant mast and light fishes, &c., as before. Reef the topsail and set it.

TO SEND DOWN THE WRECK OF A TOPMAST.

A frigate in the Mediterranean, some years since, had her main topmast so shattered by lightning, that it was impossible to slack any of the rigging without the greatest danger of the mast falling, when the following plan was adopted: A light spar was attached to each side of the topmast; these spars were then lashed every three or four feet, round the spars and topmast together; when done, the mast was unfidded; two carpenters were then stationed on the lower cap to cut away the splinters, that they might not impede the lowering of the mast, and at the same time to cut the spars placed on each side of the mast, and a sailor to remove the lashings as the ends came near the cap. The mast was again lashed to a hawser in its descent, by hands stationed under the main top for that purpose; the mast was then received on deck with the greatest safety. Whereas, if the mast had been allowed to fall, much injury must have been done to the rigging, and perhaps to the ship.

TOP-GALLANT MAST CARRIED AWAY.

Reeve a hawser through a block at the topmast head, and send down the wreck as convenient. By hooking a snatch-block at the mast head, and snatching the top-gallant yard rope, it may be used in sending the wreck down. If a top-gallant mast is sprung, send it down and send up another.

NOTE. *All sprung* spars should be shifted if possible.

THE JIB-BOOM IS CARRIED AWAY.

Set the fore topmast staysail, heave to or reduce sail. If running free, bring by the wind. House and send down fore top-gallant mast. Get the wreck in with the top-burtons, or pendant-tackles on fore stay, assisting with staysail halliards, fore clew-jiggers or lee fore buntlines, as necessary. Gather in the jib, turning out the stay as soon as possible. If the wreck cannot be hoisted on board, and is thumping under the bows, cut it away at once. Reeve heel-rope and send in the stump.

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LOWER CAP SPLITS.

Take all sail off the mast; send down top-gallant mast and shift the lower cap if you have a spare one; if not, pass a lashing round the topmast and lower mast head, which wedge; afterward, woold and wedge the cap and make sail.

THE TRESSLE-TREES ARE SPRUNG.

Take all sail off the mast; send down the top-gallant mast; reeve top-pendants and hook top-tackles. Sway up on them until all strain is off the fid, when rack and belay. Pass a lashing round the topmast and lower mast head, and make sail.

MAIN CHAINS CARRIED AWAY.

Go round if possible. If not, take all sail off the mast, steady it with the pendant-tackles and set the shrouds up with luffs to the cradle-bolts.

Replace what chain-plates require it with spare ones, and keep them out in place with a chock of wood between them and the ship's side; then set the rigging up properly.

MAIN YARD CARRIED AWAY.

Take in main sail and main topsail. Unbend the former and send it down if possible. Send aloft the pendant-tackles and hook them to bolts in the cap. Put a strap round each quarter of the yard; hook to them the pendant-tackles, and land the two pieces on deck with the pendant-tackles, burtons and lifts, using the main top-bowlines to keep them forward, clear of the mast. Use the jeers in sending down the heaviest piece, if thought necessary.

Single the weather main tack and lee main sheet, hook them to the clews of the main topsail, and set it flying. Now fish the yard in one of the gangways.

If the yard is sprung, to send it down and fish it, proceed as follows: Unbend and send down the sail, and send the studding sail booms on deck if any are on the yard. Reeve the jeers and hook them, hook the burtons to the burton straps; send aloft and hook the yard tackles to their straps; hook the lower blocks to bolts in the opposite waterways. Hook a tackle from forward to keep the yard clear of the mast. Take the jeers to

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the capstan. If the ship is rolling *heavily*, one of the truss pendants may be hitched loosely to its strap on the opposite quarter, to keep the yard from getting adrift. The blocks are turned out at the ends, of course. If patent truss, use rolling tackle.

Heave round and pull up on the burtons; when high enough unshackle the slings, come up the trusses or unkey the navel bolt, and lower away, carefully tending the braces, thwartship and fore-and-aft tackles. Land the yard across the nettings and lash it. Strip it of everything in the slings, and knock off the battens. Fish the yard with the fishes on hand supplied by the navy-yard.

TO GET A LOWER YARD DOWN INSIDE THE RIGGING.

If the yard is badly sprung, it is better, if possible, to get it down on deck to work on it.

To do this, say to get the main yard down on the starboard side, hook two pendant tackles to straps around the lower cap, and on either quarter of the yard to take the place of jeers; hook port main top-burton from topmast head to a strap on the port yard-arm, just inside the shoulder. Have one fore-and-aft tackle to strap around the centre of the yard. The port top-burton is for cockbilling the yard, and the fore-and-aft tackle for getting it forward to clear the navel-bolt and for guying it clear of the mast. Have a mizzen top-burton to hook to starboard yard-arm when down in the gangway; also a thwartship jigger forward to bouse the port yard-arm over to the starboard side when low enough. Single the lifts and tend the braces.

Forward preventer braces would be useful in this case; if up, the after braces may be unrove at once.

Now man the jeers and pull up; unhook the slings and unkey the navel bolt; set well taut fore-and-aft tackles. When all is clear, man the port burton and walk the yard right up and down, settling a little on the starboard jeer to allow the yard to pivot from the port quarter, and tending the forward braces and fore-and-aft tackle to keep the yard clear of the top rim. The starboard yard-arm will now be down in the starboard gangway, where it may be unrigged, the mizzen top burton hooked, and a thwartship jigger from port side of quarter-deck, if found necessary.

Have casks or solid chocks ready to land the yard on. Now man mizzen top burton, and ease away on the jeers and port main top burton, keeping a strain on the fore-and-after tackle, and using the thwartship jiggers as necessary. Land the yard on the chocks.

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It is well to stop the port fore-brace out of the way beforehand, to avoid fouling the upper yard-arm.

In sending the yard aloft again it may be well to get it athwart-ships, reeve lifts and braces, and then sway aloft.

TO FISH A LOWER YARD.

The fore yard of the English frigate "Thetis" was carried away at the slings into two separate pieces. These were sent down, stripped of the rigging, and battens placed straight along the deck, with their lower sides downward, the ragged ends trimmed, and the fracture shut in by bowsing the pieces together with tackles on different sides. Two iron fishes were then nailed on the foreside of the middle, and the yard chocked steadily as it lay. The after part of the middle was then cut away in a form to receive a half-anchor stock, which was bolted through the yard. One long fish, which had meanwhile been tapered and hollowed, was placed at the after side of the yard, shutting in the anchor stock and nailed on. Chain straps were then passed round all in several places and set taut with iron wedges; between these the wooldings were hove on, and work having been commenced at 8 A. M., the yard was in its place and sail set on it at 5 P. M. The ship had meanwhile been turning to windward, a mizzen topsail having been set as a fore topsail, and a reefed main topsail bent to the spare main topsail yard as a fore-sail. The hoops taken off the bunt of the yard were driven on the ends of the fish, and this yard did duty long after without showing a symptom of weakness.

TOPSAIL YARD CARRIED AWAY OR SPRUNG.

Clew up and unbend the sail, send it on deck or gather it up in the top. If the yard is broken in two, send the smaller piece down with the burtons, and then with hawser from topmast head, send down the other piece.

If the yard is sprung send it down in the usual manner. Studding-sail booms may be triced up and down topmast rigging. Fish old yard or send up spare one.

GETTING THE "MINNESOTA'S" MAIN YARD ON DECK.

The "Minnesota's" main yard having been badly sprung in a collision which occurred while entering the harbor of Hong-Kong, it became necessary to send it down for repairs. These were

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made by sawing the yard in two, removing the splintered portion and scarfing in a piece of the foremast of an English sloop-of-war which was given for the purpose, the scarf being securely banded.

In sending the yard down, instead of using jeers, a two-fold purchase was rove with a six or eight inch manilla hawser, through two stout single blocks lashed at the main topmast head, above the eyes of the rigging, and two similar ones in the slings of the yard; the fall being snatched and taken to the after capstan.

This purchase was assisted by the pendant-tackles, hooked to a long strap over the main cap, and the burtons hooked to the burton straps. The pendant-tackles, however, bound against the forward part of the lubber's-hole and were of little use.

A stout fore-and-aft tackle was hooked to the starboard fore and main yard-arms, the fore yard being supported by a preventer-brace taken out on the bowsprit.

The fore topsail tyes were racked aloft, and the lower blocks of the halliards hooked to the starboard main yard arm, to assist in rousing it forward.

The lifts, trusses, and braces, were unrove, and when all was ready the yard was swayed up, the slings unshackled, the fore-and-aft tackle and topsail halliards well manned, and the capstan "walked back" handsomely.

Owing to the *long drift* of the main purchase, little or no difficulty was found in dipping the starboard yard-arm over the smoke-stack, the port one inside the rigging, and landing the yard in the port gangway; the whole was done in a very few minutes.

The yard was sent up by reverse means, being first swayed up above the rail, then squared and landed; the lifts and braces were rove and the yard swayed aloft in the usual manner.

FISHING THE MAIN YARD OF AN ENGLISH 90-GUN SCREW-SHIP.

The main yard of H. B. M. S. "Hero," in 1861, which had carried away entirely, was fished with the following spars in about ten hours, and stood perfectly in heavy weather afterward:

One fore topmast studding-sail boom,

One fore top-gallant studding-sail boom,

One main top-gallant studding-sail boom,

Fourteen capstan bars,

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Three fishes, and

One elm plank 2½ inches thick by 11 wide and 24 feet long.

These spars, with 300 fathoms of 3½ and 4½ inch rope used for wooldings, weighed 1 ton 18 cwt., being 14 cwt. more than the two main topmast studding-sail booms, which were not replaced aloft.

All fished yards are heaviest on the damaged side, therefore the yard arm requires an extra support.

TO MAKE A TEMPORARY LOWER YARD.

The two topmast studding-sail booms are equal in length to the lower yard.

With these for the length, the yard is made up by the most convenient spare spars, woolding all together with a number of well-stretched lashings.

RUDDER GONE.

Rudder-bands were the origin of rudder-chains. In ancient times vessels had frequently a rudder at each end ("double-enders"), and in bad weather, the rudders were triced up, while the ship "drove;" being let down again when moderate. When rudders became hung as at present, the fastenings remained for the purpose of retaining the rudder when bumped off on the ship's grounding, and seamen made use of them for steering purposes when any injury befell the rudderhead. The possibility of this latter application has sometimes been overlooked; and not only have the fastenings on the rudder not been sufficiently far down, but common bolts inserted instead of a strong metal strap which should clasp a large portion of the after part. An improvement has recently been made in this respect by placing a preventer tiller in the after part of the rudder, as explained in Chap. VII., page 93.

In arranging the gear of the temporary rudder in a screw-ship, it would be necessary to take the guys through the screw aperture under the after bearing, and thence up on their opposite sides. They should, of course, be well covered at the nip. When the guys lead to the quarters, they should be turk's-headed, or keckled, so as to keep them clear of torn copper.

Formerly it was a common practice during heavy gales and seas, both at anchor and at sea, to insert the rudder chocks, and thus by steadying the rudder head prevent the dangerous and

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violent motion of the tiller, tiller-ropes, and wheel, which occurred whenever a sea struck either side of the rudder itself.

It has also been customary when lying-to, in very bad weather, to lash the helm hard a-lee, and with the aid of proper after-sail, keep the ship close to the wind, bowing the sea.

It may safely be said that the old practices referred to are very questionable; the fineness of the *run*, the large aperture in the dead wood, the dash of water from the screw, the increased size and weight of the rudder itself, the necessary alterations in its gear, all conspire to render the steering apparatus more liable to injury than heretofore.

Perhaps in lying to, the same effects as lee helm might be produced by keeping the screw down: but this would probably depend on its form; that is, if it were right or left handed, and which tack the ship was on.

Men-of-war are generally supplied with spare pieces with which, in cases of necessity, to construct a temporary rudder.

In the absence of these one may be constructed by using a spare topmast for the main piece, and building out from it in the proper form, using enough pig-iron ballast to sink it. To supply the place of pintle and gudgeon it has been proposed to make use of a spare lower-cap. In constructing the rudder on deck, the topmast is placed through the round hole of the cap, while the wood abaft the square hole is cut away so that it will fit on the stern-post, where it is secured after the rudder is got over, by means of guys leading through ports well forward.

The topmast, cut the proper length, comes up through the rudder hole, and the vessel steered by guys attached to the rudder outside.

CHAPTER XXXII.

SHIFTING SAILS AND SPARS.

SPLITTING SAILS.

SAILS, when split, should be taken in and repaired aloft if possible; if not, then shifted. The new sail should be ready on deck, and can be sent up to windward as the old one goes down to leeward. If the sail splits so as to be of no further use, unbend and send down at once. If not, keep it on the ship until the new one is ready.

A reef-tackle-cringle, or any part of the leech, can readily be repaired aloft by the sailmaker, in moderate weather. The officer of the deck need only clew up the clew requiring repairs. Men on the yard gather the sail up, the yard being, of course, clewed down. In chase, or being chased, it is absolutely necessary to shift sails (if required to do so at all) quickly. If carrying studding-sails on one side only, the others can be shifted over and set if anything happens to those set.

If the jib splits, set the fore topmast staysail, cautioning the man at the helm to "mind his weather helm;" take in spanker if necessary.

If the foresail or fore topsail splits, take the sail in, repair it aloft or shift it. Reduce after sail to *balance* the ship. Caution the helmsman as before.

If a topsail splits across the head, or if, in turning out a reef, the sail is torn, and it is not convenient to shift it, take the reef in again.

TO SHIFT A JIB.

Haul the sail down—gather it on the boom, and put on good stops.

Come up the jib-stay, and bend the marrying line.

Unbend tack-lashing, jib-sheets, and bend a rope's end for an inhaul.

Overhaul the halliards, and secure the bight round the head of the sail, taking care that the hanks may still travel up and down the stay.

Pull up the halliards! Ease away the downhaul!

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When high enough, ease in the jib-stay the lee side—haul in on the inhaul.

When on the forecastle, unbend the marrying-line, and unreeve the jib-stay from the hanks.

Reeve jib-stay through all the hanks of the new sail, and bend the marrying-line.

Shift the halliards, downhaul and inhaul, from the old to the new sail, securing the bight of the halliards round the head of the sail as before.

Pull up the jib halliards! Haul out on the marrying-line and jib-downhaul.

Lower the jib down to the boom, pass the tack-lashing, and bend the jib-sheet.

Cast off the bight of jib halliards, cut stops—set up the jib-stay.*

Hoist away!

TO SHIFT A TOPSAIL (BY THE WIND, UNDER ALL PLAIN SAIL).

Trice up and hook the sail burton round the topmast head.

The new sail (say the main topsail) is in the weather gang-way ready for bending. Clew up the main royal and top-gallant sail.

Man the main topsail clewlines and buntlines! Weather main topsail brace! Let go the main to' bo'line!

Haul taut! Clear away the sheets! Clew up!

Settle away the main topsail halliards! Round in the weather brace!

Lay the yard nearly square, and set taut the braces.

Aloft topmen! Man the boom tricing lines!

Trice up! Lay out! FURL AND UNBEND!

Unreeve the first and second reef-earings from the sail (supposing them to be *bull-earings*).

Unbend the topsail sheets, clewlines, bowlines, reef-tackles, robands, and head-earings, securing the bunt-robands to the buntlines.

Lower the sail down the weather side by the buntlines.†

* With the customary hide-bridles the jib-stay is not unrove, but the bridles cast off and the sail sent in as before.

† It is very frequently found more convenient to send the sail down forward and to leeward of the mainsail, into the lee gangway.

SHIFTING SAILS.

Send up the new sail, with the sail burton before and to windward of the old sail.

Cut the stops on the sails as it passes the top.

When the clews are above the top—"high enough."

See the turns out of the sail.

Bend the reef-tackles, hitch to them the head earings and haul out.

Bend the sheets, clewlines, bowlines, and buntlines.

Lower the bunt of the sail level with the yard.

When the fore part of the top is clear of men, cut the stop in the bunt.

Pass the bunt-robands, head-earings, and robands; reeve the first and second reef-earings.

Haul home the topsail sheets.

Stand by the booms! etc.

Man the main topsail halliards! tend the braces, let go and overhaul the gear! Haul taut!

HOIST AWAY THE TOPSAIL!

If the furling gaskets are secured to the head of the sail instead of the yard, they are of great assistance in a gale of wind, by enabling the robands to be unbent from the yard, leaving the sail furled; then by hooking the sail-tackle to a strap in the bunt of the sail (abaft the topsail yard and lower lift), the topsail may be easily lowered through the lubber's-hole, taking care to have guys from the deck.

TO SHIFT A COURSE (MODERATE WEATHER).

The new sail (main sail) being ready, stretched across the deck forward of the mast, yard-jiggers on the yard, lee lift taut—

Main clew garnets and buntlines!

Haul taut! UP MAINSAIL!

Aloft main-yard men!

Lay out! FURL AND UNBEND!

Hand the sail; unhook reef pendants; stop buntlines to head of sail. When ready—

Stand by the earings! EASE AWAY! *Lower away the buntlines!*

All the gear coming down with the sail. Unbend and bend to new sail, stopping buntlines and leech lines to the head. When ready—

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Man the gear!

Buntlines and yard arm-jiggers are manned last, a few hands on the clew-garnets and leech lines, hands to lighten up tacks and sheets.

Haul taut! SWAY ALOFT! HAUL OUT AND BRING TO!

The yard-arm jiggers are run out, leech lines hauled up; bend the sail, loose it and hook the reef pendants.

Man the main tack and sheet! and set the sail.

TO SHIFT A COURSE IN A GALE.

Suppose, for instance, that you have split a reefed course, and wish to replace it by another.

Haul it up as in blowing weather; cast off a few of the reef-points and rope-bands along the yard, and clap on several good stops around the sail; secure the buntlines around the body of the sail, and then cast off all the reef-points, rope-bands, reef-earings, and leechlines; cast off the lee head-earing and rouse the lee clew, by a line from the top, into the body of the sail, and secure it to the buntlines; then, having a line from the deck forward attached to the body of the sail, ease off the weather-earing, and lower away.

Having the other sail in readiness, stretched across the deck, and properly fitted for bending: bend the buntlines and leechlines, and toggle the bowlines; pass several good stops round the body of the sail; hook the jiggers from the yard-arms to the first reef-cringles, and hitch the head-earings to the standing part of the jigger; hook the bunt-jigger to the centre of the head of the sail, and secure the buntlines to two or three of the first reef points; man everything and sway aloft, *Lay out lower yard men!* Bring the sail to the yard square, and a taut head, hook the reef-pendants, hook the burtons to them, and rouse them well up: bend and reef the sail, shackle the tacks and sheets, hook the clew garnets, and set it as in blowing fresh.

TO SHIFT A TOPSAIL IN A GALE.

Having split a close-reefed topsail in a gale, unbend it and bend another.

Take in the sail and furl it. Cast off a few reef points of each reef, and rope-bands to enable you to pass several good stops around the sail.

SHIFTING SAILS.

You may either send it down by the buntlines or the top-gallant yard-rope; if the latter, secure it around the body of the sail, cast off the buntlines, unreeve the clewlines, sheets, and reef-tackles, then cast off the reef-points and earings of each reef; cast off the rope-bands, keeping fast the head-earings; bend a line to the lee head-earing, and rouse the sail into the top; then lower away by the yard-rope, bear the sail clear of the top, ease off the weather earing, and guy it into the weather gangway as it is lowered.

Having the other sail in readiness and properly fitted you may send it up by the top-gallant yard-rope, buntlines, or sail burton, forward of the top.

But it is desirable to have as little surface as possible exposed to the violence of the gale, which would retard the operation or endanger the sail; for this reason, a topsail may be reefed from the foot, before sending it aloft, and then, after the head is brought to the yard, you may take the reefs out from the foot, as you take them in on the yard. To this there is an objection; the men on the yard finding it exceedingly difficult to cast off the reef points from the foot; it is recommended instead, to make the sail up with the reef-bands together, the points all being out fair, and then to pass several good stops round the sail at certain distances apart, which will not prevent the men from bringing to or reefing the sail.

The sail may be reefed on the foot by taking each reef in separately, using rope yarns and cutting them as required.

REEFING ON THE FOOT,

Is done in the following manner: Stretch the close reef of your sail taut along the deck, take the clews as near where they will haul up on the yard as you can; trace the clews down clear to the foot of the sail; haul the foot of the sail taut, without moving the clews out of their places; gather the foot as near the close reef as possible; then tie your fourth reef round the foot, then your third reef, until all your reefs are expended round the foot of the sail, minding to keep the reef-knots, as near at hand as possible, to be ready for casting off; by this means, you bend your sail without exposing more than one reef at a time, until you set your close-reefed sail.

Becketed topsails are extremely convenient for sending up reefed to any extent.

SHIFTING SAILS.

UNBENDING SAILS IN BLOWING WEATHER.

Previous to the order being given to unbend sails, let every man stationed on the yards be provided with a sail-tie, or a length of spun-yarn, sufficiently long to go twice round the sail. Every man takes his stop aloft, and when he has seen his robands clear, he then passes his stop twice round the sail, keeping his yard-gaskets fast until the sail is quite ready for easing in. Sails may be unbent in this manner without danger almost in any weather.

TO SHIFT A CLOSE-REEFED MAIN TOPSAIL. (ANOTHER METHOD.)

Proceed as in taking in a close-reefed topsail; steady the yard, lay out, furl, and unbend the sail. The men on the yard gather up the sail, cast off reef-points and pass them around all parts of the sail, wherever possible. Pass the gaskets, ease off the robands. Put a strap around all parts of the sail amidships, keeping fast some of the midship robands to do so; overhaul down and hook the burton. The reef-pendants are unclinched, and bowlines untoggled and passed in to the slings of the yard; the men in the tops unshackle or unhook the sheet and clewline blocks; and the buntlines are untoggled. Overhaul the weather topmast studding-sail halliards in, and make a running bowline round both parts of the strap amidships; this is for the purpose of keeping the sail to windward while lowering, and if the studding-sail halliards are not rove, use the weather top-bowline for the same purpose. Bend a rope's end to the lee head-earing to haul it in to the bunt. The sail is now hung amidships by the burton, earings ready for easing in, a few robands yet fast, and all gear unbent.

Bring in the lee-earing and secure it to the bunt, and bend on a rope's end from deck to both earings.

Brace the main yard in (carefully tending trusses, rolling tackle, &c.), until it is square. Sway up the burton, take a turn, cut the remaining robands, haul taut the topmast studding-sail halliards or weather bowline, and lower away, easing away the weather earing as necessary, and hauling down on the tripping-line.

If the main yard cannot be braced in, send the sail down abaft it.

The topmen aloft now put on the yard-arm jiggers, and have everything at hand for bending the new sail.

SHIFTING SAILS.

The men on deck will prepare the new sail for going aloft, in the following manner:

Get the new sail up on the main deck, stretch it along and open it out (it is, of course, ready for bending). Haul the head of the sail taut along by taking the head earings to a couple of train bolts in the deck. Haul out the first reef-earing to ring bolts on either side, gather the sail up by little at a time, until the reef-band is up to the head; lay the points along, but do not tie them. Haul out the second reef earing in the same manner, gather up the sail, as though *reefing on the yard*, by little at a time, and tie the points round the head of the sail with a single bow. Haul out the third and fourth reef-earings, gather up the sail and tie the points round the head in the same manner; square knotting the points of the third reef, and half knotting those of the fourth. Bring the buntline toggles into the head of the sail and stop them amidships. Carry in the clews, outside the buntline-toggles, and leave them well out. Furl the sail on the head *as though it were on the yard*, throwing all the sail possible in the bunt to lighten the yard-arms, and leaving out clews, buntline and bowline toggles, and reef-tackle bridles; half-hitch each reef-earing to the cringle above, and seize the second reef-cringle to the reef-tackle bridle. Pass the gaskets. Put a strap round the sail amidships; hook the burton, bend on studding-sail halliards, or weather bowline; also, rope's end, and sway aloft, keeping the sail well to windward. When the sail is up to the yard, toggle the buntlines, shackle sheet and clewline blocks, and pass a rope round the topmast and both parts of the buntlines to keep the midship seam amidships; sway up, toggle the bowlines and clinch the reef tackles; hook yard-arm jiggers, haul out (lowering the burton), pass midship roband and haul the reef-tackles out, and clewlines up. The sail will now lay along the yard with the second reef-band taut along in consequence of its cringles being stopped to the reef-tackle bridles. Cast off the studding-sail halliards, pass head-earings, cut the seizing on the back of the burton hook (buntlines taut), but keep fast the gaskets until the sail is brought to and reefed. Rouse the sail up by the second reef points, untie and tie them round the yard (first and second reefs in one). Cast off third and fourth reefs in same manner, passing the earing well, and hauling after legs of fourth reef well taut. All being ready for setting, *Man the lee-sheet, tend the gear, haul taut, ease down lee clewline, haul home to leeward, ease down weather clewline, haul home to windward.* Hoist the yard clear of the cap and steady it. Haul taut reef-tackles to relieve the close reef earings. The main yard is braced up sharper than the topsail yard before sheeting home.

SHIFTING SAILS.

NOTE. In sending down a topsail it is all-important to *point it fair, before lowering.* Therefore try to keep it well to windward, clear of the main stay and yard (if sent down abaft it).

The fore storm-staysail can be hauled down and storm-mizzen set if necessary to keep the ship to.

In sending down and up a sail when running with the wind abaft the beam, first heave the ship to if it can be done.

If a main topsail splits, when lying to, of course, it must be unbent immediately, and the other sent up when ready; but if we wish merely to shift the sail, have the new one ready *before starting* anything aloft.

TO SHIFT A COURSE IN CHASE.

If, in chase, you are unwilling to lose the effect of a sail, while replacing it by another, you may perform both operations at once, thus:

If a course, get the one you wish to bend (which we will distinguish as the new one), stretched across the deck under the yard; get up the yard-jiggers, and hook them to the first reef-cringles of the new sail; unbend the buntlines from the foot of the old sail, haul up the ends, and send them down between the yard and the old sail; bend them to the new one, stopping them to the head as before. Stopper the clews of the old sail, and shackle the tack and sheet blocks to the clews of the new one; the topmast studding-sail halliards may be bent to the head-earings of the old sail to lower it by.

While this is doing, the men on the yard will hook the bunt-jiggers or a tackle, and stop the forward leech-lines, to the head of the old sail; and cast off the rope-bands.

Man the yard-jiggers and buntlines, and run the new sail up to the yard abaft the old one; and while they bring the head of the former to the yard the latter is lowered on deck by the bunt-jiggers, forward leech-lines, and head-earings, a line being attached to the head cringle to lower by; after the old sail is down, bend the forward leech-lines to the new one.

SHIFTING A TOPSAIL WHILE THE OTHER SAIL IS STILL SET.

If, in chasing off the wind, you have any reason to doubt the strength of either of your topsails, from being much worn, or from having split in shaking a reef out, or otherwise, you had

better shift it at once as the chase may try you by the wind. This evolution can only be practised when the ship is going free, with any benefit to her speed. It has been done by some good officers in the following manner: We will suppose the fore topsail the one to be shifted; middle the sail to be bent, across the fore stays, stopper the clews of the topsail, unbend the fore topsail sheets and buntlines, have good burtons on the fore topsail yard-arms, and well boused taut. If neither of your fore topmast studding-sails are set, overhaul the halliards down, and bend them on to the first reef-cringles; the head earings should be made fast to the topmast studding-sail halliards, or whips used for that purpose, as you do to the yard-arm jiggers in bending a course. Send a light burton down before the topsail, and hook it in the centre of the head of the topsail; single your topsail sheets, and bend them to the clews of the spare sail, bend your buntlines to the proper places on the foot of the sail, but do not make fast the robands to them; bend the fore top-gallant bowlines to the head of the topsail by the robands, about halfway out on the head of the sail, so as to keep the sail going up clear of the points of the one bent; when all is quite ready, man everything together, and send the sail up as a flying sail; be careful to get a good pull of the reef-tackles, before the men lay out on the yard to unbend and bend sails. It will require the greatest care in displacing the earings of one sail, and placing the earings of the other; when your robands are fast, you may let the old sail hang by the reef-tackles, then run your clewlines up high enough for sending the sail on deck, with the help of the burton at the mast head, which must be shifted abaft the topsail yard for so doing.

TO SHIFT A TOP-GALLANT SAIL OR ROYAL.

Take in and furl the sail, unbend the gear, get the yard on deck, shift, cross the yard, bend the gear, and set the sail.

On board of a first-rate, a top-gallant sail may be unbent aloft, sent down by the royal yard-rope or top-gallant studding-sail halliards, and the new sail sent aloft by the same means, and bent, hauling the earings out by hand.

TO SHIFT A JIB-BOOM.

Strike the fore top-gallant mast.

Unbend the jib and flying-jib, unreeving the jib-stay. If the wythe is fitted with a hinge, the flying-jib stay need not be unrove, merely unclamping the wythe.

SHIFTING SPARS.

Check the flying guys and martingale; let go the heel and belly lashings; haul out on the flying heel rope. When the heel is clear, *Ease in!*

The flying-jib boom, with the rigging on it, is left alongside the bowsprit, the head resting on one of the bowsprit shrouds or the spritsail gaff.

Ease up the laniards of the jumpers, guys, and backropes. Haul taut the jib heel rope and take a turn well aft.

Hook the fore topmast staysail halliards to a strap round the jib-boom end; haul them taut and keep them manned.

Unclamp the heel.

Ease in! pulling up the staysail halliards as the boom comes in.

Use the inner studding-sail halliards or fore clew-jigger, to steady and lift the heel of the boom over the gunwale.

As the boom comes in, the funnel, or band, and rigging are stopped up on the fore part of the bowsprit cap.

A jigger on the fore stay is used to steady and lift the head of the boom, shifting the strap out as the boom comes in; or, if great care is taken, the jib-halliards may be used.

Land the boom on the forecastle, with the head resting on the hammock netting. Shift the heel rope, inner studding-sail halliards, and jigger to the new boom, which has been brought forward while the old one was coming in.

Haul away the heel rope! Attend the inner halliards and the jigger. After the boom is pointed and rigged, hook on and attend the staysail halliards, easing away as the boom goes out.

When far enough out, clamp the heel.

Pull up the backropes and jumpers.

Haul out on the flying-jib heel rope, and secure the boom with the heel and belly lashings. Bend the jib and flying-jib.

Send up fore top-gallant mast.

TO SHIFT A TOP-GALLANT MAST.

Send down the royal and top-gallant yards.

Unreeve the yard ropes.

Come up the top-gallant and royal rigging, and Jacob's ladder-laniards.

SHIFTING SPARS.

Start and attend backstays and stays, hanging the backstays in the top.

Sway away!—out fid—*Lower away!*—out preventer-fid (if used).

Pass the lizard as the head of the mast comes below the cap.

Bear the heel off the topsail yard.

Lower the mast on deck—*heel aft*, and after side up.

Unsnatch and shift the mast rope and lizard to the new mast, taking care to see it clear of turns.

Sway away!

Cast off the lizard as soon as the mast-head enters above the topmast tressle-trees, then sway it through the top-gallant funnel.

Place the royal rigging and truck, and reeve the royal yard rope—*Sway away!*

Place the jack and top-gallant funnel—reeve the top-gallant yard rope—*Sway away!*

Enter the preventer-fid as soon as possible—light up all the rigging.

When the fid is entered, *Launch!*

Steady taut the stays and rigging.

Cross the top-gallant and royal yards.

The snatch for the mast rope may be fitted with a bolt through both parts of the heel, and forelocked in to keep the mast rope from coming unsnatched.*

At sea the mast is sent down abaft, and to windward of the topsail yard, and when blowing hard, through the lubber's hole.

A hole should be bored in the heel of the top-gallant mast above the proper fid hole, for the preventer-fid, as a mast rope frequently carries away in the final pull.

TO SHIFT A TOPSAIL YARD.

Trice up and hook the sail burton at the topmast head, or use the top-burton if good.

Take off the quarter blocks, securing them to the lower cap.

* The open sheave in the heel of a top-gallant mast, though very convenient, is by no means common.

SHIFTING SPARS.

Unbend the sail from the yard, and haul it into the top, overhaul the buntlines well and unbend the reef-tackles from the sail, but nothing else.

Hang the hauling part of the reef-tackles, studding-sail halliards, and top-gallant sheets to the eyes of the lower rigging, to keep them from unreeving at the mast-head, and to have them ready when the new yard comes up.

Trice up the fly-block with top jiggers, unshackle the tie-blocks from the yard.

Take the tack-blocks off the top-gallant studding-sail booms, hitching the tack round the strap of the block.

Get the studding-sail booms up and down the topmast rigging, with the boom tricing-line and top-gallant studding-sail halliards.

Unreeve the top-gallant sheets and topsail reef-tackle.

Knot the end of the studding-sail halliards and round them up.

Hook the burton to a pendant* on the yard, which may be secured on the quarter with a lizard, or to a strap well backed.

Bend a top bowline to the slings of the yard, as a fore-and-aft guy to clear the jaws of the topmast first, and afterwards of the top.

Attend the topsail braces and lifts, cast off the parrel on one quarter of the yard, and *Sway away!* pulling up on the sail burton.

Unrig the lower yard-arm on deck, and the upper yard-arm in the top.

Steady the lower yard-arm well forward, as then the upper yard-arm is kept close to the top for the men working aloft.

Take off the boom-irons, flemish-horses, jewel-blocks, first and second reef-earings, lifts and braces.

When the rigging is taken off, keep it clear for the new yard.

Lower the yard on deck; lower yard-arm aft, using the main or mizzen stay-tackle.

Shift the burton and stay-tackle to the new yard, and *Sway away!*

* The object of using this pendant is that it may be secured to the centre of the yard and stopped out on the quarter after the manner of a royal yard rope, to trip the yard on swaying. It is only used when exercising topsail yards. (See plate 49.)

Ordinarily a hawser would be taken for a yard rope, and would be rove through a single block lashed to the topmast head.

SHIFTING SPARS.

When up and down, rig the new yard as the old one was unrigged.

The bowline bent to the upper quarter of the yard will keep it clear of the fore part of the top.

Attend lifts and braces—*Sway aloft!*

As the lizard passes the top, cast off, and let the yard cross itself.

Pass the parrel-lashing, and secure the lifts as soon as possible.

Reeve the reef-tackles and the top-gallant sheets.

Replace the studding-sail booms and put on the tack-blocks.

Secure the quarter-blocks, the standing part of topsail clew-lines, and shackle the tie-blocks.

As soon as the reef-tackles are bent, haul out and bend the sail.

Haul home the topsail sheets and hoist the topsail.

If one topsail tie is used to assist the sail burton, cast off the standing part from the topmast head, and bend it round the quarter of the yard.

In shifting a yard at sea, send it up and down on the weather side. If possible, take the course in and square the lower yard, but if the course is obliged to be kept set, hook a top burton from the topmast head to the weather lower yard-arm for a preventer-lift, then let go and overhaul the lower lift to clear it of the yard.

(After crossing the new yard, if the jaws have fallen to leeward, or the yard does not rest fairly on the cap, and consequently will not allow the parrel to be passed taut at once, use a rolling tackle to rouse it over to windward.)

TO SHIFT A TOPMAST.

Send up one top-pendant and tackle, the jeers, and a large hawser.

Reeve the top-pendant in the dumb sheave and the hawser in the live sheave, first reeving it through a thimble fitted as a lizard, with two good tails.

Send the top-gallant studding-sails down out of the top. Any ropes or whips which may be wanted must be hung from the top rim, to prevent them getting under the topmast rigging as the mast comes down Hang all the backstays abreast the top.

SHIFTING SPARS.

Send down top-gallant yard and mast, getting them both on deck.

Secure the top-gallant and royal funnels, and the truck on the fore part of the cross-trees.

Secure the top-gallant studding-sail booms and the bunt of the topsail to the topsail yard, bend one of the top bowlines to the centre, cast off the parrel on one side, attend the topsail halliards, braces and lifts, haul forward on the bowline. Let go the reef-tackles and top-gallant sheets, and when clear of the lower cap, lower the topsail-yard across the fore part of the top, lashing it there. Clear away the topmast rigging, backstays, and stays, starting all the laniards, except one stay and the weather back-stays, which are attended as the mast is swayed. Man the top tackle fall, take a turn with the hawser. Let go the topsail halliards and lifts and all the ropes that go to the topmast head. *Sway away!*—out fid—*Lower away!* Man the top-gallant mast rope to assist the mast down, overhauling the top tackle fall as requisite. Brace up the lower yards—the main on the starboard, and the fore on the port tack; overhaul the trusses, and if necessary, unshackle them and trice the bights up by a rope led down through the lubber's hole.

When the futtock-band for the top-gallant rigging is a little above the lower cap, stopper the hawser. Cast off the standing part of the top-pendant and unreeve it, hanging the upper top tackle block to be ready for the new mast. Take off the futtock-band, haul the hanging blocks and the topmast rigging taut out under the cross-trees. Put bell-ropes on the cross-trees to steady them.

Secure the hawser for surging the topmast to start the cross-trees off the mast head. If the cross-trees are six feet above the lower cap, about three fathoms of the hawser will be required. See the cap-shore secured in its place and all the men clear.

Let go the stopper on the hawser. Surge the topmast.

If the cross-trees hang the mast, take the hawser to the capstan, heave the mast up and surge as before.

When the mast head is clear, secure the topmast cross-trees, funnel and cap on top of the lower cap. Pass the two tails of the lizard round the topmast, *below the hounds*, taking two round turns with each tail and then knotting them together; hang it with a small rope from the topmast head to keep it from slipping down.

SHIFTING SPARS.

Lower the topmast with the heel down the hatchway before the mast until the head is clear of the tressle-trees. Bend the end of a whip from the lower yard arm round the mast head and haul forward; when the head is before the top rim, heave round the capstan. Hook a burton from aft to the heel; when the heel is above the coaming of the hatchway, haul aft the burton, lower the hawser and land the mast on deck.

Lash a runner block on the fore side of the new mast, two thirds up. Reeve the jeers through the jeer-block at the mast head and the runner block on the topmast; secure the standing part by taking a half-hitch round the topmast above the runner-block and securing the end through the fid-hole to prevent the lashing slipping up. Unreeve the hawser from the old mast and shift the burton, and whip from the lower yard-arm, from the old to the new one.

Man the jeers, and walk the new topmast up, with the head pointing before the top. Lower the heel down the hatchway, slue the mast round with the fore side forward, point it and land it on the deck, lighting up all the gear well. Cast off the jeers. Reeve the hawser and heave the mast up. As soon as the heel is above the lower yard, square the yard and haul taut the trusses to catch the mast if anything is carried away. Reeve the top pendant and fid the mast with the top tackle and hawser; set up the rigging. Sway up the topsail yard, fid the top-gallant mast, and cross the top-gallant yard.

The backstays and the stays must have luffs on, and the slack taken in as the mast is lowered. In going up, they must be eased off.

With the patent truss of latest design, the topmast may be sent down through it, and without interfering with the lower yard.

CHAPTER XXXIII.

CHASING.

TO CHASE TO LEEWARD.

THE chaser will steer a course slightly converging to that steered by the chase; taking the bearing by compass and measuring the angle subtended by the masts. By constantly keeping the chase *on the same bearing*, the chaser will attain the chase in the shortest time possible, and by the shortest route.

If the course steered by the chase is more advantageous than that steered by the chaser, the latter can steer a parallel course to take the same advantage, until he arrives as near as possible (that is, abreast of him), and then steer a course to cut him off.

TO CHASE TO WINDWARD.

The chaser will stand on the tack which carries him nearest the chase, and will tack whenever the chase bears abeam. The *exact* point when the chaser should tack is when the chase is nearest him, this will be on his beam when sailing on parallel tacks; and on the other tack, *between the direction of the wind and abeam*. The practical rule given is the best, for although the chaser stands on rather too long when on the contrary tack, yet he avoids tacking so frequently.

If the chase kept constantly on the same tack, the chaser would not reach him quicker than by standing on the same tack until he could fetch him on the other (for a ship gains more to windward by tacking less frequently), but if the chaser stands on and brings the chase abaft the beam, the latter would undoubtedly tack and thus gain an advantage. Moreover, if the chaser stands on in this manner the chase may bear up, or try another course more favorable, and unless the chaser keeps the chase as nearly in a line with the wind as possible, *any change of wind is in favor of the chase.*

A vessel chasing another should persevere although the chase should sail the faster, for a shift of wind, a lucky shot, or other things, may give him the advantage.

CHASING.

Chased from to Windward. The vessel chased should employ every means to retard the time of being overtaken. A few cables' lengths more may suffice to save the chase; because a fog, an injury to the chaser, or night coming on, may enable him to escape.

The chase should then never despair, but by availing herself of every change of wind or mismanagement on the part of the chaser, do her utmost to get off.

She should, as a rule, run on the course opposite the bearing of the chaser, or one or two points on either side if a greater speed can be attained.

Chased from to Leeward. Having ascertained her inferiority of sailing, the chase will trust to the chances afforded by shifts of wind, &c., or the blunders of the chaser, to escape.

The chase cannot do better than to keep on the same tack, unless the chaser stand on too long before tacking, in which case the chase will go about.

Should the chase possess the property of shooting ahead in stays in a remarkable degree, or should it be known that the chaser is a bad working ship, the chase may tack frequently, to cause the chaser to do the same.

Should the chaser stand on until able to fetch the chase on the other tack, the latter will then tack, and by running two or more points free, compare her sailing on another point.

In the above case the chaser is supposed to sail better than the chase. The officers in charge of a vessel, either chasing or chased, should constantly take the bearings, and angle subtended by the masts of the other.

The trim of the ship should be carefully attended to.

STEAMERS.

Under Steam, to Chase to Windward or Leeward. The chaser being under steam, will manœuvre as in "chasing to leeward," making sail when it will draw.

Under Steam, Chased from to Windward. The chase will manœuvre as in Article, "CHASED FROM TO WINDWARD," making all sail.

Under Steam, Chased from to Leeward. If the chaser is a steamer, the chase will manœuvre as in Article, "CHASED FROM TO LEEWARD," but if a sailing vessel, the chase will steam directly to windward.

CHAPTER XXXIV.

PREPARATIONS FOR ANCHORING—ANCHORING—SELECTING A BERTH—ANCHORING IN A TIDEWAY—RIDING AT SINGLE ANCHOR—ANCHORING WITH A SPRING.

GENERAL REMARKS ON ANCHORING.

SHIPS, on getting within signal distance of the senior officer, are required to show their number, and on this being recognized, that officer gives his number in return.

Local signals, or temporary additions to the signal books, general orders, and copies of the squadron routine, should be procured without delay after joining company.

Shortening "all sail" together, in coming to anchor, however well done aloft, cannot but crowd the decks at a time when you want silence and the power of carrying out a sudden alteration in your plans. Except when you want to "charge" into a station with great way, or catch breezes over the land with your lofty canvas, the seamanlike way to come to is under topsails, after the courses and upper sails have been "whipt in," and the upper yards well squared by the boatswain's mates from the tops. You can then feel your way with the topsails, deaden it with a check of the braces, freshen it with a small addition of canvas, or stop it by heaving aback.

When about to shorten sail, get the marks on the lee lower lifts down; clew up; man all the braces, and lower and square all together.

In coming in, while blowing hard, get as much sail reefed and furled as you can spare with prudence, the top-gallant masts on deck, top tackle gear rove, studding-sails out of the rigging, and the cables double-bitted. If running, round to before letting go.

If you break adrift from one anchor, it is best to let go two at the same time.

If you have not double-bitted before coming to, do so without delay. You not only relieve the wood work, but can veer with less jerking.

Always double-bitt before anchoring in deep water, as at Madeira, &c.

ANCHORING.

Should you use a buoy, do not part with it until veering obliges you. A sheet buoy is very apt to foul the bower cables.

If you want to back your anchor with another one, on account of dragging, or the danger of doing so, put an anchor shackle on the riding cable; shackle the end of the backing anchor cable (taken outside all) to this; look out for, or give the ship a sheer, and let go.

The rolling motion may be checked, when at anchor, provided there be not too much wind, by making sail and bracing by. This is no unimportant object, especially in handling boats.

No one who could help it would moor in a roadstead. At single anchor a ship is ready for sea, and her remaining anchors are disposable for a gale from any quarter.

The old rule for giving the proper scope to ride by, was three times the depth of water; but a far safer rule would be five or even six times the depth, and in the long run the latter would be found the more economical of labor.

In coming to an anchor, it is desirable to run the cable out straight, clear of the anchor, after letting go. To do this we must either wait for sternway before letting go, or else let go while there is headway on, and pay out roundly.

For the former there must be wind enough (if there is no tide), to force the ship astern. In the latter, there is the chance of damaging the copper and snapping the chain, and thus of running on board a vessel which we had reckoned on clearing. It is evidently an unnecessary risk in strong breezes, and therefore only adopted in light, when the risk is small. The mizzen topsail is often set aback to give the ship sternboard.

The object in thus laying out the cable is, that not only will the anchor be clear, but that (except in strong breezes and tides) the ship will ride far from her anchor by the mere weight of the chain, where it rises from the bottom.

The inconvenience of boating experienced in an outsider are trifles compared to the dangers that are inseparably connected with an inshore anchorage. A close lee shore in a gale, with one ship drifting in the hawse, and another too close astern to admit of veering, are the prices which must be paid for having what is sometimes called "a snug berth." A real good berth is to be well to windward, at single anchor, and (on making up for the night) to have the boats in and up, topsails treble reefed, a reef in the mainsail, staysails bent, top-gallant masts on deck, yards pointed to the wind, cable ready for slipping, spanker

ANCHORING.

double reefed, and guns secured. Being thus ready for the worst, the ship may be called "snug."

When becalmed at night in a tideway or current, in the neighborhood of foul ground or land, ease an anchor down to the hawse-hole with a slip rope hawser, and then lower it by the cable a few fathoms below the ship's draught. The chances will be in favor of its bringing the ship up before, perhaps, she strikes the ground.

PREPARATIONS FOR ENTERING PORT.

It will be assumed that the ship has had a long and boisterous passage, and that she is approaching her port of destination under favorable circumstances, pleasant weather, and with a reasonable prospect of making a speedy run in.

On striking soundings, bend chains and get the anchors off the bows. A day or two before making the port, send down any extra rigging that may be aloft, scrape and grease spars, get the upper masts in line, and see that all the "square marks" are on the lifts and braces. Scrub paint-work inside and out, and if found necessary give the ship a light coat of paint outside, by rubbing off with rags steeped in oil and lampblack. Touch up all chafes on the spars aloft. The morning before going in holystone decks, and scrub boats, spars, and oars. Sling clean hammocks the evening before.

As you near the port, send down all chafing gear, lower the boat davits and square the boats, having them all ready for lowering, have all the half ports squared, and see that no ropes are towing overboard. Have sentry boards placed, and sentries ready for posting, the accommodation ladder scrubbed and ready for shipping. All sheets snug home, and sails up taut, clew-jiggers hooked. If anticipating a long stay in port the studding sails may be unbent, the gear unrove, tallied, and stowed away. If intending to moor immediately after anchoring, pass the messenger for the chain of the anchor first let go. The officers and crew should be dressed in the uniform prescribed by the captain. Every preparation should be made for firing a salute, and the flags to be used, in readiness.

Sometimes the topsail sheets, and fore and main tacks and sheets are singled to facilitate the taking in of the sails.

If coming in under steam alone, have all the sails neatly furled, yards squared, and rigging hauled taut.

When entering a port at any time, day or night, have the colors set.

ANCHORING.

Upon nearing the anchorage, the captain directs the officer of the deck to call "All hands bring ship to anchor." The first-lieutenant then takes the trumpet and officers and crew repair to their stations. The officers following the executive repair in the order of rank to the forecastle, main deck, starboard and port gangways and mizzen mast. The navigator being personally responsible will see that both anchors are ready for letting go, that the chains are bitted and clear for running, compressors thrown back, with men to man the falls, hook-ropes, stoppers, &c., at hand.

After satisfying himself in regard to the ground tackle, the navigator returns to the quarter-deck, to pilot the ship in.

The junior officers are distributed about the ship to the best advantage.

The principal stations of the crew are at the wheel, lead, anchors, conn, signal, clew jiggers, and buntlines, downhauls, and brails, and weather braces. Hands by tacks and sheets, halliards, outhauls, bowlines, lee braces, and on the lower yards to overhaul the topsail sheets. Also hands by the compressors, and hook rope on the main deck.

Only those men stationed aloft will go there; all others must keep below the rail, out of the chains and clear of the ports. Care should be taken that the general appearance of the ship is neat and seamanlike.

When the sails are clewed up, the strictest silence should be preserved, even the creaking of blocks is objectionable, showing that they have not been properly attended to. Sometimes all the noise is monopolized by some zealous but indiscreet officer, junior to the executive; as this is a direct reflection upon the latter, it should not be tolerated.

As soon as the sails are furled, lay down all but the square-yard men, send a boat ahead, square yards haul taut and stop in rigging and pipe down.

Get the lower booms out, rigged for port, and lower boats according to circumstances.

A catamaran should be constructed, that the copper may be scrubbed and oiled the morning after coming to.

Immediately after anchoring the navigator gets bearings of the prominent objects in sight, that the ship's position may be plotted on the chart. These bearings must be entered in the log.

On piping down the first lieutenant gives up the deck to the officer of the watch.

ANCHORING.

HAVING A LEADING WIND, TO RUN IN AND ANCHOR. (NO TIDE.)

Call all hands, bring ship to anchor! See that all the officers and crew are on deck, and at their stations. *Stand by to take in all the studding-sails and royals!* After the men are stationed, take them in, giving the order, *Haul taut!* IN STUDDING-SAILS AND ROYALS! Rig in and get alongside the studding-sail booms, make up and stow away the sails, trice up the gear, take the burtons off the topsail yard, and jiggers off the top-gallant lifts.

Man the top-gallant clewlines! Fore clew-garnets and buntlines! and when ready, *Haul taut!* IN TOP-GALLANT SAILS, UP FORESAIL!

The moment the order *Haul taut* is given, the top-gallant yardmen should lay aloft from the top, and after furling the sail snugly, lay down on deck.

Square the lower yards by the lifts, and let the captains of the tops square the top-gallant and royal yards.

Man the topsail clew-jiggers and buntlines; jib downhaul! spanker outhaul! At this order hands lay out on lower yards to overhaul topsail sheets. Have hands stationed by the topsail sheets and halliards, jib halliards and spanker brails; and to attend the braces. Bear the spanker boom over on the quarter.

When near the anchorage, put the helm to starboard or port, as the case may be, having allowed for head-reach in bringing her to the wind. Then give the order, *Haul taut! Let go the topsail sheets!* CLEW UP! *Haul down the jib! Haul out the spanker!* As soon as the sails shake, having the wind abeam, *Settle away the topsail halliards, clew down!* Take in the slack of the braces as the yards come down, keeping them square. The buntlines are hauled up above the yard, the clews hauled forward by the clew-jiggers, and a few of the topmen pass in the leeches ready for furling.

She comes to the wind by the effect of the helm and spanker, and as soon as she loses entirely her headway, give the orders, *Stand clear of the cable! Stream the buoy! Let go the starboard* (or port) *anchor! spanker brails!* and as soon as she swings to the anchor, *Brail up the spanker!*

Direct the navigator to give the ship the requisite number of fathoms of chain, which, when secured at, he is to report; furl sails, square yards, haul taut rigging, and pipe down.

If coming in before the wind, or with the wind well aft, the head sails may be down, or hauled down before shortening sail.

ANCHORING.

If the crew has been well drilled, all the studding-sails, top-gallant sails, royals, and foresail, may be taken in together—and this, when well done, has a fine effect.

The best command to give on such occasions, where everything is started together, is :

Haul taut! SHORTEN SAIL!

This should be done in time sufficient to admit of getting the sails, booms, and gear, out of the way before taking in the top-sails.

The top-gallant sails and royals should be furled at once, but they may be left hanging and furled with the rest after coming to, if you have a full crew.

It is not advisable to attempt to reduce a "cloud" of canvas at once, unless the crew and rigging are in such a state as to insure success.

TO COME TO "HEAD ON."

But if there is not room to take the necessary sweep, in coming to anchor with the wind aft, check-stoppers should be put on the cable to deaden the headway. Having clewed up the sails in good time, furl them, that you may approach the anchorage with as little headway as possible. The anchor being let go, the checks, breaking one after the other, serve to stop her headway before the range is veered to.

TO STAND IN ON A WIND AND ANCHOR.

Coming to anchor with the yards braced up, you must have the weather braces well manned, and have hands ready to square the lower lifts, before the topsails are clewed up; and the moment the order is given to *clew up*, let the braces be hauled in, and the lower lifts hauled taut to the square mark. Some officers square the yards by the braces before they clew up the sails. This hastens to stop her headway, and it is proper and even necessary in some cases, as, for instance, in coming to in a crowded harbor, or where you have little room. But it renders the operation of clewing up difficult, from the sails being aback and binding against the rigging. This latter mode is, however, approved of in light winds. Others clew up the topsails, and then manning all the weather braces, order, *Settle away the topsail halliards!* SQUARE AWAY! When circumstances permit, this is preferable.

As soon as the cable is taut and the anchor ahead, "veer to" on the cable, giving it to her as she will take it.

ANCHORING.

Standing in on a bowline under all sail, the most approved method is to shorten sail to topsails, jib, and spanker, and to come to under that sail.

Everything being in readiness, give the command—

Man the fore and main clew garnets and buntlines!

Top-gallant and royal clewlines, flying jib downhaul!

Aloft top-gallant and royal yard men!

Having hands by the tacks, sheets, halliards, and lee braces, and weather top-gallant and royal braces manned, order, *Haul taut!*

UP COURSES! IN TOP-GALLANT SAILS AND ROYALS, DOWN FLYING-JIB! Or simply—

SHORTEN SAIL!

The sails are clewed up, yards clewed down, and squared in by braces.

Furl the top-gallant sails and royals, stow the flying-jib!

Next order—

Man the topsail clew-jiggers and buntlines!

Jib downhaul!

At this order the men stationed there lay out on the lower yards to overhaul topsail sheets, and a few hands are sent to the spanker sheet.

Stand by the starboard (or port) *anchor!*

When it is judged that the ship can be luffed up into her berth, order the wheel—

Hard down!

Haul taut!

Let go the jib halliards! HAUL DOWN!

Clear away the topsail sheets! CLEW UP!

The spanker sheet is now hauled over till the boom is amidships; the jib is hauled down snug, and the topsails clewed up. Then—

Man the weather braces! Stand by the topsail halliards!

Settle away the topsail halliards! SQUARE AWAY!

At this order the topsail halliards are settled away roundly, and the braces hauled in to the square marks.

The quartermaster in the chains, judging by his lead will report when headway ceases; as soon as the ship commences going

astern, *Stand clear of the starboard cable! Let go the starboard anchor!* If a buoy is used, first, *Stream the buoy!*

When head to wind put the wheel amidships, and secure it and brail up the spanker.

Let her take the chain from the locker if she will, and do not pay it down in a lump under her fore foot. If the wind is so light that, even with the mizzen topsail set, she will not take the chain, you must wait either for the tide or a stronger breeze to send her astern.

The anchor being down—

*Stations for furling sail!**

Man the bunt-jiggers, have hands by the clew-jiggers and buntlines, &c., and proceed to furl. Should it be found, after clewing up, that the ship head reaches too much, and is in danger of fouling another vessel, sheet home and hoist the mizzen topsail. Should this prove insufficient drop the foresail.

TO ANCHOR WITH A SCANT WIND.

Running in with a scant but good working breeze, a ship, by a series of *half-boards*, might work up in a crowded harbor to a position not otherwise attainable, the manœuvre being attended with greater success with a favorable tide.

Or having the yards braced sharp up, and everybody at their stations, *Clear away the topsail sheets! Clew up!* and keeping fast the halliards that the yards may remain pointed to the wind, stand on under jib and spanker, luffing all she will. *Man all the weather braces! Jib downhaul! Hands by the topsail halliards! Lee fore and main lifts!* and when up to your berth, *Haul aft the spanker sheet! Hard down! Haul down the jib! Settle away the topsail halliards! Square away!* When she loses headway, let go the anchor, furl sails, square yards, haul taut the rigging and pipe down.

TO ANCHOR HEAD TO WIND IN A NARROW CHANNEL.

Stand in close to one side of the channel, and when nearly abreast of the berth, clew up the fore and main topsails, at the same time hauling down the jib. Put the helm down, haul out the spanker, and brace the mizzen topsail sharp aback. When head to wind, let go the anchor, and clew up.

Anchoring in a narrow channel or harbor, with the intention of mooring, you will let go the first anchor on the weather shore,

* This is better than calling "all hands."

and moor with an open hawse either in or out of the harbor, to the prevailing wind.

The necessity of these precautions will appear evident, if you should ever find yourself riding to a gale of wind with a cross or elbow in the hawse, cables chafing each other, and injuring the cutwater.

In the chapter on TIDEWAY, so much is said of the effect of the tide in reference to the management of a vessel, that but few remarks will be necessary on the subject of coming to anchor in a tideway. The directions therein contained for working or drifting *down* a river, the precautions necessary to avoid fouling other vessels, giving yourself room for drift, avoiding eddy currents, and keeping the vessel constantly under the influence of the helm, will also govern you in working *up* the river to the anchorage.

BEATING IN ON A FLOOD TIDE, TO ANCHOR.

If, having a head wind, and tide favorable, you work *up*, you will, when near the anchorage, put the vessel before the wind; and, keeping her under the management of the helm, with sufficient sail set to stem the current, you may, by reducing or making sail, drop with the tide, shoot ahead, or sheer to either side with the helm, until you have arrived at the proper spot for anchoring.

Always come to, however, with the head of the ship to that which is the stronger, either the wind or the tide. Let the last tack be that which will bring you close to the weather shore; reduce sail to the jib; put the helm *up*, and wear short round till the ship's head approaches the flood tide (should the tide prevail), then down jib; let go the anchor and furl sails; otherwise, anchor as if no tide.

Unless the wind be very light, sail should be furled as it is taken in, lest she overrun her chain.

FREE WIND AND EBB TIDE, TO ANCHOR.

Having the tide running out, with a fresh breeze in your favor; and having, by sufficient sail, forced your way through the water to the anchorage; reduce sail until she becomes stationary, when you may drop the anchor. Furl sail at once.

In a tideway you will always moor with one anchor up and the other down the stream, for you will never, except at slack water or in a violent gale, ride to the wind.

ANCHORING.

When anchored with a chain cable, it is sometimes the practice to ride by a long range without mooring. In ordinary weather and good holding ground, the vessel will swing without passing over her anchor, riding by the bight of the cable, without straightening it. When the harbor is not crowded with vessels, and you expect to remain but a short time in port, this will answer very well; but it would not be prudent to neglect mooring, if you are to remain more than a few days at most; for, in case of bad weather, you may overrun and trip the anchor, or be in danger of fouling other vessels. This, however, must depend greatly upon the nature of the bottom in which the anchor is let go. In any harbor where the anchor and chain settle deeply in the mud, a vessel may safely ride by the bight of a chain, even to a fresh breeze.

If you anchor with the expectation or probability of engaging in fight, springs should be attached to the rings of the anchor before letting them go. Hawsers or a stream cable may be used for the purpose.

RUNNING UNDER DOUBLE-REEFED FORE AND MAIN TOPSAILS AND FORESAIL, TO ANCHOR.

After bending the bowers, rouse up and bend both sheets; get the upper yards on deck; send down the top-gallant masts, send the studding-sails out of the tops; get up and reeve top-pendants and jeers, and make all preparations before coming to, to house topmasts, and send down lower yards immediately after anchoring. Weather-bit the chains and have the compressors well manned. As you near the harbor, haul up the foresail, and take in and furl the fore-topsail. Have reefed spanker or storm mizzen ready for hauling out.

Clew up the main-topsail when some distance from your berth, and when near it, put the helm hard down and haul out the spanker. Send the men aloft to furl the foresail and main-topsail, and as she rounds to, with the wind on the bow, let go the weather bower and veer away roundly. When out to a good scope, from forty-five to sixty fathoms, according to the depth of water, let go the lee bower, and when head to wind, brail up the spanker. Bring her up gradually, veering to from ninety to one hundred and twenty fathoms on the first, and forty-five to sixty on the second.

Bring an equal strain on both cables and stopper well. Now house topmasts, &c., &c., as necessary.

ANCHORING.

ANCHORING OFF A COAST, OR IN A ROADSTEAD, WHERE IT WILL BE NECESSARY TO GET UNDER WAY IN CASE OF BAD WEATHER.

In anchoring off coasts, or in exposed roadsteads, preparations must immediately be made for slipping and going to sea in case of bad weather. In coming to in such a case, we would let go that anchor *from* which we expect to cast when slipping. If anchoring off Tampico, for example, let go the port anchor, as, if we slip, it will be in a *norther*. Before furling sails, single reef the courses and double reef the topsails. Have storm sails bent, and be prepared for a gale at any moment. Put a slip buoy rope on the chain, and be sure to keep the shackle well abaft the bitts. It would be well to stopper before it, and start the bolt to insure slipping when required to do so. The buoy-rope is intended to weigh the chain, and if buoys are not generally used for the anchors, we must, at all events, use one in this case.

While lying at anchor under these circumstances, hoist your boats in every night, if you are using them; all the outside boats will, of course, be hoisted. The officer of the deck, at night, should see the topsail sheets clear, and have a hand by the drift-lead. It is the practice to keep an *anchor watch* on deck when lying at single anchor.

Upon the first indication of bad weather, all hands will be called, and, if time, the anchor hove up; otherwise, the chain must be slipped. All anchors are kept ready for letting go; for something *might* occur to prevent slipping.

TO PICK UP MOORINGS.

When the ship returns to an anchorage from which she has previously slipped, it is considered a neat thing for her to pick up her chain without letting go another anchor. To do this, reduce sail to topsails, lower a boat and coil a hawser away in her, and send her to pick up the buoy-rope of the chain, with directions to bend the hawser to it. Tack off shore, if necessary, to allow the boat to pick up the buoy, and let her make a signal when she has done so. Stand in and round to, to windward of the buoy; clew up and signal the boat to pull aboard. Take the end of the hawser in through the hawse-pipe, clap all hands on it and run it in. As the chain comes in, be sure to get enough in to allow for bitting; when that is done, clap on stoppers forward of the bitts, bitt and stopper abaft, and shackle as shortly after as possible.

ANCHORING.

TO ENTER A PORT AND MAKE FAST TO A MOORING BUOY.

In some harbors, as at Malta, Cherbourg, &c., moorings are planted for vessels to ride by, in order that they may occupy, when swinging, as little space as possible.

The same general directions may be observed here as in the former case. The boat may be either sent out with the hawser to make fast to the buoy, or she may leave with the end just after clewing up. The ship is warped up close to the buoy, and the bower chain unshackled from the anchor and shackled to it. Now veer a few fathoms, and put a *bull-rope* on the buoy from the end of the bowsprit, to keep it clear of the stem.

Picking up moorings is very good exercise for the senior class on board the practice-ships.

TO ANCHOR BY THE STERN.

This may be resorted to in a very small harbor, the vessel being too long to turn; in a narrow stream when not desirable to swing to the tide, or when intending to attack an enemy at anchor, or a fortified place. The English, at the battle of the Nile, and the French, at Sebastopol, anchored in this way.

1st. Rouse up the sheet chain, pass it through the after chain pipe, and using slip-ropes, haul the end forward by a ring-rope and shackle it to the bower, keeping its own chain bent. Range enough of the bower chain that the sheet alone may bring the ship up. Have plenty of stoppers at hand, and the chain bitted. Clew up and furl in good time, that the ship may not have too much headway, and let go when ready. Having both chains bent to the anchor, the ship is moored with a bridle, as it were, and by heaving in on one and slacking the other, her broadside can be sprung around at pleasure.

2d. If to anchor without the spring, shackle the sheet cable to its proper anchor, and "come to" as with a bower, using slip ropes to avoid injury to rudder or screw.

The United States brig "Eagle" having previously mast-headed her topsail yards, shifted her berth during the battle of Lake Champlain, and anchored by the stern in a new position, for which contingency she had made ample provision before the action commenced.

ANCHORING.

TO ANCHOR WITH A SPRING.

The foregoing method is probably the best, but it may be modified by using the stream chain, which would be more convenient to handle than the sheet; or a hawser may be substituted, bending it to the ring of the anchor before letting go; or afterwards to the cable just outside the hawse; then by setting taut the hawser and veering on the cable, the ship's broadside is sprung around. Ships may be sprung broadside to the wind, in warm climates, for the purpose of better ventilation; or in engagements at anchor, to bring the guns to bear on various points.

Using a spring from the bower anchor or cable, for the purpose of getting a ship's broadside to bear *steadily* on any object, can never be equal to the steadiness acquired by using a *second* anchor, with a stream cable or hawser. If you have taken up a good position with the spring, and your broadside bears well, you never can depend upon keeping the ship's position for any time, as it will be liable to alteration with every change of wind or tide. Suppose a ship to be running in with the wind from the sea, to engage a battery, or vessels at anchor. She has anchored, and sprung her broadside to the object; while firing, the wind comes off the land (no uncommon case near high land), the ship must then drop over or past her anchor, until she lays her broadside by the anchor and spring on the opposite, or in-shore side, which increases her distance from the object fired at, and lays her open to much annoyance from the enemy's fire, while perhaps very few of her guns will bear. A spring is at all times little to be relied on, compared with a stern anchor. After it becomes dark, a spring will much decrease the certainty of your practice. If a ship has a good scope of cable with one anchor ahead and the other astern, rather tautly moored, and her broadside bearing well on the object, there will be little fear of her shearing about much. But should it be requisite to fire at night by previous bearings, with the quoins of the guns marked for elevation, then to make the practice more certain, it would be well to have two kedges, with two good, strong hawsers laid out on the off side, one on the bow and the other on the quarter; the hawser from aft being attached to the anchor on the bow, and the one from forward to the anchor on the quarter; these two hawsers crossing each other at a good angle, with as much scope as possible, well bowsed taut, will insure the direction of the guns by bearings at night, and steadiness of aim by daylight.

ANCHORING.

THE "SARATOGA" AT THE BATTLE ON LAKE CHAMPLAIN.

As the success of the "Saratoga," in this action, was mainly due to the superior seamanship of her officers, as evinced by the manner of working her kedges and hawsers, a brief description of that part of the action may be instructive, since we are told that the "Confiance" (English), with but one spring on her cable, got just so far round as to hang while exposed to a raking, while the "Saratoga" was "entirely successful, springing her broadside successively on every vessel wearing the British flag."

The American vessels had each its stream anchor hung over the stern, the cable bent ready for use; and besides the usual springs, the "Saratoga" had a kedge planted broad off each bow, the hawser of each leading in through the quarter ports, the bights hanging in the water. In the midst of the fight, on firing the only gun (a carronade) remaining mounted in the starboard battery of the "Saratoga," the navel bolt broke and the gun flew down the main hatch. The attempt was then made to wind the ship.

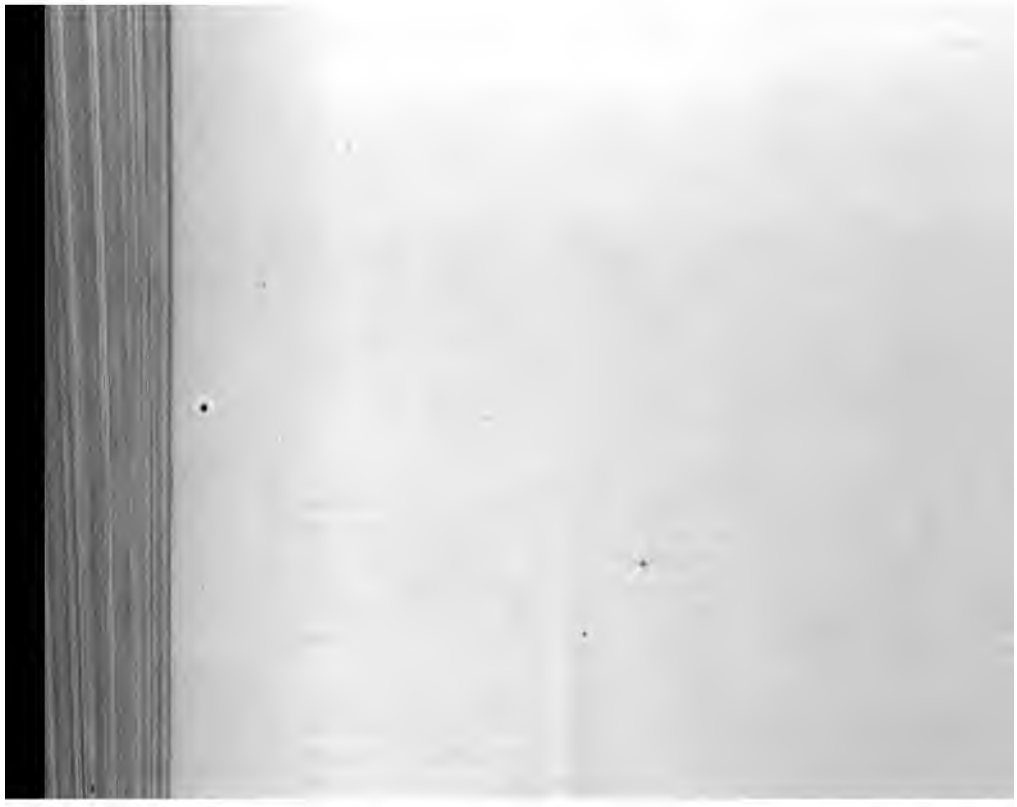
To this end the stream anchor astern was let go, and clapping on the starboard quarter line, the ship was roused over to the kedge on that side; a line had been bent to the bight of the stream cable, and she now lay with her stern to the raking broadside of the "Linnet" (position 2, Fig. 402, Plate 81), being for a brief space in a critical position, but dipping the port quarter line under the bows, it was passed aft to the starboard quarter, the ship's stern sprung to the westward, and the port battery brought to bear on the enemy.

TO ANCHOR ON A LEE SHORE.

Having attempted, in vain, to claw off a lee shore, and finding that our only safety lies in anchoring, all cables must be bent and anchors cleared away. If it is supposed that the four anchors will be insufficient to hold her, they must be backed with kedges or with guns. Everything must be ready for housing topmasts and sending down lower yards; and axes must be at hand in case we are forced to cut away the masts. Anchors are backed when the holding ground is bad; when the ground is good, a ship would probably hold on longer and would *certainly ride easier*, with all the chain on two or three anchors, but vessels are provided with *four*, and there is a responsibility in this act which captains (very naturally) do not like to assume.

PLATE 81

Fig. 402.



ANCHORING.

To back our four anchors, we would use the stream to back the weather sheet, and the three heaviest kedges for the others. The stream cable and largest hawser should be middled and cut, to use as backing cables. Bend one end to the stream or kedge, and the other to the anchor to be backed.

When all ready with the anchors, get the ship under fore-and-aft sails, furling the square sails at once. Keep her a little off and let go the stream and weather sheet; then the weather kedge and bower; haul down the head sails, down helm, let go the lee kedge and bower, and finally, the lee kedge and sheet. The object is to drop them clear of each other, *and as nearly together as possible*, and parallel with the shore.

The weather sheet is the only anchor buoyed; veer away on all the cables to the end. Get the topsail yards across the forward parts of the tops; house topmasts and send down lower yards. Throw the deep-sea lead over the bows to tell whether or not she is dragging. If she does so, prepare to back your anchors with some of the guns. To do this, pass the two stoutest hawsers you have through the hawse-holes (or bow ports) on either side, *underneath* the cables, and bring their ends in to the cascables of the aftermost guns you intend using; clinch them there and lash them to those guns forward of the trunnions, near the muzzle; pass the bights in the ports, and on top of the guns next forward, under the cascables, where, lash them, and lash again on top near the muzzle; do the same with them all, leaving sufficient slack between each gun, so that they can be thrown overboard one at a time, commencing aft. When they are all overboard, bend on other hawsers and veer away *without attempting to ride by them, as the ship drags.* The anchors will finally drag until they are in the place where we threw the guns overboard, and our hope is that the ship may be brought up by the flukes of the anchors catching in the bights of the hawsers. Throw overboard all the remaining guns, and cut away the masts.

Our only hope of safety now lies in our anchors and chains; and if the latter part, try to get her before the wind, and run bows on to the beach. When decided to cut away the masts, the foremast may be spared if there is any chance of saving the crew by running for any particular spot, otherwise cut it away, and *hold on* to the last. *Never* slip your cables and run for the shore in the hope of making a *lee* by laying the ship in a slanting direction; if the anchors drag she may as well go ashore stern foremost as in any other way.

Having once struck, your first object is to get a line ashore, and save the crew. Various methods have been proposed and

adopted. Gilley's "Shipwrecks of the Royal Navy," instances a number. Lifeboats are furnished, along some parts of our own shores, as well as the shores of England, for the purpose of assisting wrecked vessels.

In backing an anchor after it is down, the backing hawser or chain must be taken round the riding cable and secured loosely in order that it may slide down and along it when the backing anchor is let go. A large shackle might be used for this purpose on the riding cable, and the backing chain shackled to it.

BACKING AN ANCHOR.

If in preparing for hurricane weather, heave in or veer away on the anchor down, say best bower, till you bring the fourth shackle some few fathoms abaft the bitts; stopper, unshackle, and unbitt; pass the end out and shackle it to the ring of second bower, which has been eased down to the hawse hole; off stopper, and ride by second bower cable, with its anchor at the bows until the gale comes on, and then veer it down to the ground. Should the gale pass off, you can hang the best bower cable outside by the clear-hawse pendant, and replace both in their original position.

If on veering to sixty fathoms on second bower, you found the gale still increasing, shackle the remaining hundred fathoms of the best bower to it (supposing that there are three cables divided between the bowers, as is usually done); let go starboard sheet anchor, and veer away on both. Finally, if compelled by the violence of the storm to make the utmost of your resources, shackle the other sheet cable to the end of the one already down, and veer away on both to within a few fathoms of the clinch, keeping that in to freshen the nip of the hemp cable with. You will then, it is to be hoped, ride it out with three anchors down, and five hundred fathoms of cable ahead.

With more than two cables ahead there is little probability of the strain being equally divided, unless they are systematically laid out in fine weather; and, with four anchors down, ships have snapped their cables one after another, partly from the same cause, and partly from the fatal effects of sudden jerks upon a short scope, such as a hundred fathoms would be in a gale of great severity. But an anchor is backed only when the holding ground is bad.

A length of two hundred and fifty fathoms on one anchor is perhaps unnecessarily long, though in the above case it was demanded by the position of the sheet anchor, which you were

obliged to veer on, because (as generally happens in practice) it was not dropped until, having veered on the riding cables, you were compelled, on account of the increasing wind, to let it go. But, to ride a storm out, you should certainly not have less than one hundred and fifty fathoms of chain on each anchor, in ten or eleven fathoms water; and, if no chain is expended in backing, you can afford this on each of the bower anchors when dropped near each other; veer then, three shackles on each, and hold on at this as long as you can. When the gale has set in, let go the sheet, and veer away on all three anchors; shackle the two sheet cables together, and you will then lie with three anchors ahead, with a cable and a half on each, which is probably the best disposition that can be made.

WHY WE VEER CABLE IN HEAVY WEATHER.

Sir Walter Raleigh writing, in 1650, on the improvements in the English navy, remarks:—

"To the courses we have devised studding-sayles, and the weighing of anchors by the capstane, is also new. We have, moreover, fallen into the consideration of the length of cables, and by it we resist the malice of the greatest winds that can blow; for, true it is, *that the length of the cable is the life of the ship in all extremities*, and the reason is, because it makes so many bendings and waves as the ship riding at that length is not able to stretch it, and nothing breaks that is not stretched."

If this was true of the hemp cables then in use, how much more imperative is the necessity for a long scope with the non-elastic chain!

The hemp cable is well known to possess the valuable quality of elasticity sufficient to accommodate itself to any variety of strain when used as a cable, but the chain is, on the contrary, so stubborn and unyielding, that *nothing but a long scope can render it safe;* this is equivalent to additional strength, it permits the ship to rise over each successive wave, under the constant pressure of a great strain, preventing entirely the danger of sudden jerks, which, of all other trials, is the greatest and worst to a chain.

It is a prevalent but fallacious notion, that, even when used in deep water and with a severe strain, the curvature or deflection of chain is considerable, and that near the anchor it rests upon the ground undisturbed by either the pitching motion of the ship, or the tension which she causes. At a testing strain of six hundred and thirty pounds per circular one eighth inch, the utmost

deflection was found to be only ten feet upon a length of one hundred fathoms, in ten fathoms water, with the hawse-hole a fathom above the surface; the diameter of the chain being one and one half inches, and the strain forty and one half tons.

In a common gale, which would produce this strain, not one link of the one hundred fathoms of chain will quietly rest upon the ground; on the contrary, it will be found by the experiments on a depth of ten fathoms, that 127.98 fathoms of chain are required to form a semi-catenary* when suspended in air, and 137.03 fathoms when in water, the buoyancy of which must at all times have its influence. If the strain be less than that mentioned, the curvature will be greater, and no danger need be apprehended; but in a severe gale, the force of which may be supposed equal to, or nearly equal to, a breaking strain, it must be evident that a long scope is the only way to prevent a fatal result; and any man in charge of a ship at anchor, with the necessary quantity of chain cable on board, and space astern to allow him to make use of it, but who neglects to do so, must be considered the author of his own misfortune, whether it may amount to the loss of his anchor or the loss of his ship.

TO INCREASE THE VALUE OF A LONG SCOPE.

To increase the deflection of the cable and bring the strain on the anchor, more in a horizontal direction, a heavy kedge may be shackled or lashed to the bight of the riding cable just before veering for bad weather.

LYING AT SINGLE ANCHOR, TO VEER CABLE, BLOWING HARD.

Veer away, by short drifts at a time, through the compressors and lanyards of the deck-stoppers. If it is blowing a gale, with a heavy sea, it would be necessary to veer with a deck tackle. A ship in this case, would send down her top-gallant masts, house topmasts, and send down lower yards, and let go other anchors as necessary.

TO HOUSE TOPMASTS AND SEND DOWN LOWER YARDS.

The top-gallant masts having been sent down, and the gale continuing to increase, call "all hands house topmasts and send

* A *catenary* is the curve into which a flexible chain of uniform density and thickness forms itself when suspended, or allowed to hang freely from two points.

ANCHORING.

down lower yards." The top pendants and tackles and jeers would previously have been rove and sent aloft (on the principle of always being *ready*). Man the top-tackles and jeers. If the ship is rolling, we must use thwartship tackles on the lower yards. Hook fore-and-aft tackles; single the lower lifts and hook the burtons to the burton-straps. Turn the blocks out of the truss-pendants if used; otherwise, be prepared aloft, to unkey trusses and unhook slings. Come up topmast rigging and stays, but be careful in easing the fore-and-aft stays, not to ease more than absolutely necessary.

The jeers may be worked on the gun-deck of a frigate and taken to the capstan. Have *seamen* to lower.

When the top-tackles are hauled taut to unfid, the topsail lifts, buntlines, and reef-tackles, must be overhauled, and in case the rigging has been thoroughly wet, and has consequently *shrunk*, the laniards of topmost rigging must be well overhauled. It is a good plan to hang the backstays and halliards aloft from the top, as in swaying up much weight is saved.

The lower booms must be gotten alongside before the lower yards are sent down, and the flying-jib and jib-booms must come in with the top-gallant masts and topmasts.

Some seamen think lower yards hold less wind aloft, and braced up; and others disapprove of sending down lower yards and housing topmasts both; but upon the whole, the weight of opinion is with the practice as described.

If at anchor where you might be required to get under way to save the ship, do not strike the lower yards or house topmasts, unless you intend making sail, as described in the case of the "Magnificent," Chapter XXI., page 406.

When the top-tackles are swayed upon, we must not forget to overhaul the topsail halliards, and the halliards of the head sails; in fact everything leading to the topmast heads. The gear of the courses, such as leech-lines, &c., must be attended.

Everything being manned and attended, the command is given to sway up and heave round; the braces, lifts, fore-and-aft tackles, burtons, thwartship tackles, topsail sheets, are either manned or tended as required. The topmen tend stays, back-stays, and laniards of topmast rigging, and overhaul all other rigging necessary. *Lower away* when the trusses and slings are clear, and fids out. Rest the lower yards on casks in the nettings, and lash the heels of the topmasts to the lower masts. Put tackles (luffs) on the fore-and-aft stays, and either sheepshank the backstays or set them up with luffs.

ANCHORING.

The topsail yards can either be kept in their places, or lowered across the tops.

TO FID TOPMASTS AND SWAY UP LOWER YARDS.

On the moderating of the gale, the topmasts must be fidded and the lower yards sent up. If in squadron, the top-gallant mast will probably have to follow, and sails loosed to dry. The preparatory signal may be made at seven bells in the morning watch, and every ship expected to be all-a-taunt-o a few minutes after eight, with sails hauled out to a bowline.

Before starting top-tackles or jeers, all rigging such as back-stays, halliards, &c., &c., should be well overhauled and hung from the top, and have jiggers and luffs on the stays and back-stays ready for setting up at once. The fore-and-aft stays, top-sail lifts, &c., should be overhauled beyond the old nips, so as to leave the masts free for going up. All running gear, such as reef-tackles, buntlines, jib halliards, &c., &c., must be well over-hauled.

Top-gallant mast ropes should be rove, and the masts placed fair for pointing.

When all is ready, having top-tackle falls manned, and jeer falls led to capstan, luffs, &c., tended, sway up and heave round, fid and stay topmasts, key trusses, and hook slings. Man top-gallant mast ropes, sway aloft, fid and stay top-gallant masts, square yards, and loose sails. Heave up second anchor, and in to old scope of riding cable.

CUTTING AWAY MASTS.

First pass a hawser outside the laniards of the rigging on the side you intend the masts to fall over. If the port side, cut away the mast on the starboard side, as high up as you can, for the stumps will be of service in securing your jury-masts; and, when you have weakened it sufficiently, cut away all but a pair of shrouds on each side, guided by circumstances; then get out of the way, and cut away the remaining starboard rigging, keeping fast the stays till the mast has fallen, when you free them immediately, and cut the port pair of shrouds adrift, which you will be able to get at by their being kept up by the hawser.

If all three masts are to go, commence with the mizzen mast and work forward; although, when at anchor, it is generally not advisable to cut the mizzen mast away, as it is of great service in keeping the ship steady, head to wind.

ANCHORING.

IN EXPECTATION OF BEING FOULED BY ANOTHER SHIP.

Send hands aloft to drop the foresail, screw down the forward compressor, unshackle the cable, bend on a hawser, and, as your friend approaches, slip, and give him a wide berth. In a fresh breeze, stand by to veer instead of unshackling.

If collision be unavoidable, get the swinging boom alongside, lower the quarter boat and lower deck ports, overhaul lifts and trusses, and brace the yards up on the tack opposite to the side the ship is on.

If a vessel gets athwart your hawse in a strong tide, probably the easiest way to clear is to send a kedge astern, set taut the hawser, and wait patiently for the tide to turn. When it does, you will swing by the stern, and your friend be drifted clear of you.

STEAMERS.

Steamers lying at anchor, in heavy weather, can relieve their cables very materially by getting up steam and going ahead at a rate sufficient to accomplish the object.

TO ANCHOR A STEAMER.

Ordinarily this is accomplished as follows: Steam in, "slow down" in good time, and, when near the berth determined on, stop the engine; as soon as headway ceases, and she commences going astern, let go the anchor and veer to the proper scope. With an ebb tide, anchor "head on," and the tide will carry the vessel astern fast enough to take her chain. If a flood tide, the vessel should be sheered with the helm, and the anchor dropped so that she may not overrun her chain. When there is not enough wind or tide, reverse the engines, let go the anchor, and back till the required scope is laid out straight.

"Fifteen or twenty minutes before coming to anchor, the chief engineer should be informed of the fact, so that the fires can be allowed to burn down, and the pressure of steam to fall to such an extent that the necessity of blowing off is avoided. By this means the great nuisance of blowing off steam is not only obviated, but there is a considerable saving of fuel, the fires being permitted to burn down sufficiently low to supply only the amount of steam required while working the engines by hand, rendering it much easier also on the firemen (whose duties on any occasion are arduous enough), by having a very light instead of a very heavy fire to haul."*

* Practical Notes on the Steam Engine, by J. W. King, Chief Engineer, U. S. N.

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Due notice should also be given before stopping to sound, or stopping for any purpose whatever. The observance of this rule is quite important.

On entering a narrow channel with the flood tide, a steamer could not "round to," but would have to anchor "end on," and swing to the tide; but if waiting for high water, intending to pursue her way up, she would have to anchor by the stern to keep pointed fair.

If after entering a narrow channel a steamer should find herself compelled, by the discovery of heavy batteries, or the appearance of the enemy in superior force, to go out again, the quickest way to wind the vessel would be by dropping and swinging to an anchor; then, as soon as pointed, heave up or slip, making all preparation beforehand.

Should the ebb tide be running, make use of a kedge, and anchor by the stern, giving the vessel a sheer with the helm, that the tide may catch her on the bow and sweep her around. On the flood, let the kedge go from forward to wind her, availing yourself of the helm, jib, spanker, and engine, as circumstances admit.

Some steamers, particularly propellers, turn more readily than others; and some propellers will turn more readily with the helm one way than the other.

Young officers are liable to forget the great use of the jib and spanker in turning a steamer; they are often indispensable.

The following method of turning a propeller in a small space has been tried with much success: The engine is first backed, and when the vessel commences to go astern, stop, and ring to "go ahead fast," the helm, at the same time, being put hard over. It seems that, when the engine is started ahead, it takes some time to overcome the momentum of the sternboard; but, in the meantime, the water from the screw has the desired effect upon the rudder, and the vessel's head obeys the impulse.

When ascending rivers where the turns are short, the engine should be "slowed down," or stopped, just before coming to a bend, to prevent reaching over to the further shore; and when going up against a strong ebb tide, in such a river, for example, as the Piscataqua, N. H., the engine must be stopped, and should that prove insufficient, an anchor must be let go in the bend to permit the vessel's head to swing to the new course. When pointed right, weigh and stand on. This is an extreme case, however.

TENDING SHIP.

TENDING SHIP AT SINGLE ANCHOR.

Definition of Tides.

A windward tide, is when the wind and tide are contrary.

A leeward tide, is when the wind and tide are together.

A windward ebb, is when the tide is setting out, and the wind blowing in.

A windward flood, is when the tide is setting in, and the wind blowing out.

A leeward ebb, is when the tide and wind are both setting out.

A leeward flood, is when the wind and tide are both setting in.

A spring tide, is the highest tide, and occurs just subsequent to the *full* and *change* of the moon.

A neap tide, is the lowest tide, occurring when the moon is near the *first* and *third* quarters.

Tending ship is the art of keeping an anchor clear. When hemp cables were used this was a necessary precaution, the neglect of which rendered the cable liable to foul the anchor at each turn of the tide. The object to be attained, is to keep the cable taut, and to sheer the ship on the same side of her anchor every time she swings, and keeping her as much as possible away from the anchor.

With chain cables there is not the same necessity for tending ship, as the vessel will probably ride by the bight of her chain in light winds if she has a good scope out, and will not approach her anchor.

The tide being supposed in these cases stronger than the wind, we see that after the weather flood makes, the ship will probably ride to leeward of her anchor by the bight of the chain; if now the breeze freshens and becomes stronger than the tide she will probably swing round, still being to leeward of her anchor.

By always sheering the ship on the *same* side of her anchor we insure its turning in the ground, and avoid fouling or tripping it.

The cable may be shortened in on the weather tide, and veered again on the lee. If there is no wind, and the ship drifting over her anchor, thus risking the fouling of it, the cable may be hove in until nearly up and down, veering as she tends to the new tide.

In tending ship we make use of the helm jibs and spanker. An officer understanding the effect of each, will find no difficulty

in keeping the ship away from her anchor, and sheering so that she will tend to the same side of it at each turn of the tide.

Riding to Leeward in Moderate Weather. A deep ship will ride best to windward of her anchor, because she has more hold of the tide and less of the wind; for the opposite reason, a light ship will not ride to windward at all.

No. 1, Plate 81, represents a vessel riding out the lee tide in moderate weather, with about thirty fathoms chain cable: square yards and her helm amidships.

NOTE. In all weathers a vessel should be kept to leeward of her anchor, so long as she will ride so.

It is intended to ride to leeward on the next or weather tide, therefore when the present lee tide eases, put the helm hard a-starboard, which will give her a sheer to leeward, as in No. 2.

When the tide is done she will thwart, and ride with the chain slack under foot. This is the time to *sight the anchor*. No. 3.

The helm is now of no service, so shift it hard a-port and hoist the fore topmast-staysail with the port sheet aft: the wind being on the starboard quarter, the staysail will help her away from her anchor until the weather tide makes, when she will swing to the bight of her chain, and bring the staysail aback, as in Nos. 4 and 5: and as the tide gains strength she will gradually drop astream of her anchor until it rides, as at No. 6, when the helm must be eased as the tide attains its full strength, and lashed a few spokes a-port the whole tide; if the stream be not sufficiently strong to keep a taut cable, she will require the staysail set all the tide, otherwise she will not ride quiet: the relative strength, therefore, of wind and tide will determine when it is required.

It may be observed in reference to hoisting the fore topmast staysail, in No. 3, that, had she been riding with a hempen cable, the staysail, and perhaps more than one, would have been absolutely indispensable for the purpose of keeping that cable off the ground; but in this case, where it is neither necessary nor possible so to do, so long as she has been sheered and swings clear of her anchor, the object is attained, and the staysail may be dispensed with.

When the weather tide is nearly done, put the helm hard a-port, which will give her a broader sheer to leeward, as in No. 7.

This is called *tending to windward* or *tending to a weather tide*.

When the tide changes, the wind remaining the same, say northeast, we must again go to the westward of the anchor. To do so give her a sheer with the port helm just before the tide ceases, and hoist the staysail: she will then as the tide slackens, forge ahead and thwart as before, when the helm must be shifted

TENDING SHIP.

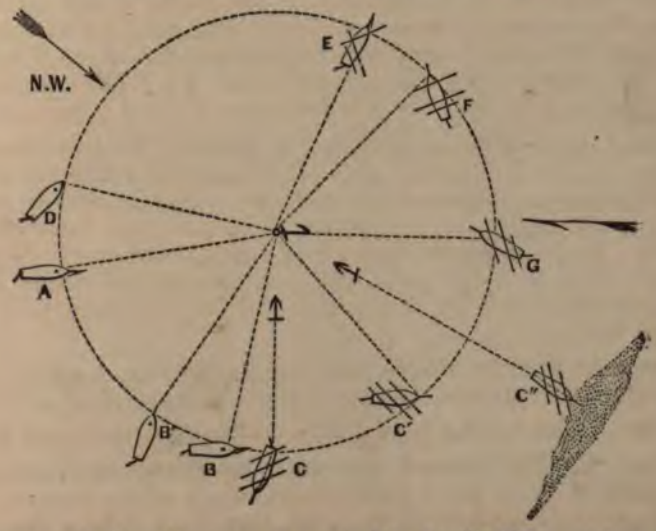
and the staysail hauled down: she will then drop astream of her anchor, and ride as at No. 1.

It will make no difference whether the ship swings with her head towards her anchor or not; all we wish is to keep her *away* from it. The second operation is called *tending to leeward*, or *tending for a leeward tide.*

If left at No. 6 to swing herself, her first movement, as the tide eases and becomes weaker than the wind, would be to forge ahead (the wind being abaft the beam), dragging the bight of her cable with her, as in No. 8; and as she thwarts, the yards being full and a drain of tide under her lee, she will shoot a little across the tide and swing with the bight of her cable on the weather side of the anchor No. 9. This on the next tide becomes a round turn, see No. 10, &c., as she cannot possibly return the way she came without assistance.

The result is a foul anchor, the chain taking a turn around the upper fluke. A fresh squall now strikes the ship, and straightens out her chain: the strain coming on the upper fluke, the anchor is tripped, and away goes the ship, fouling some of her neighbors, getting on shore, or bringing up in some out of the way place by a second anchor, or else, by continued neglect (Nos. 11 and 12), the entire scope is expended around the anchor.

RIDING TO LEEWARD IN HEAVY WEATHER.



Suppose, in the diagram, the wind to be N. W., and the ship riding to the weather tide, heading east, as at A. If now the

wind freshens, the ship will lie uneasily, and will be continually yawing about. Hoist the staysail to steady her; but should the wind freshen so as to force her into the position B, haul down the staysail and set the spanker, to prevent breaking her sheer and walking off with her anchor. By hauling down the staysail and setting the spanker, we keep her in the position B′, where she will ride in safety, though she may sheer about a great deal.

The wind continuing to increase when the ship is at B, she will forge still more ahead, and bring her anchor on her weather quarter. The yards must now be pointed to hold less wind, C′, a most dangerous position for a vessel to be placed in, as she must presently break her sheer. A light vessel would have swung head to wind long before this; and although she would sheer about with the tide under her counter, still she could not get near her anchor so long as the wind continues in the same direction.

By breaking her sheer she fills her yards, and staysail if up, and with the helm a-port as it was properly put, shoulders her anchor and shoots across the tide with it, perhaps ashore if there be shoal water in the vicinity, C″. If there be no shoal to bring her up as at C″, she will search to windward as at C, taking her anchor with her to the imminent risk, not only of herself, but of other vessels near.

The object now is to get her head to tide again, and the wind on the other side; it is evident she will not ride to leeward, she must therefore be put to windward of her anchor, a manœuvre only practicable during the strength of the tide. At any other time she would remain windrode.

Riding to Windward. Instead of riding as at A, however, it would be better to sheer her with the starboard helm, and lie to windward of the anchor as at D. If now the wind increases, we must set the staysail and shoot her into the position E, where she will remain quiet: without the staysail as long as the wind is stronger than the tide; if the wind lulls, the staysail must be set again. If she lies uneasily, the after yards may be braced up and the head yards *abox*, when she will, in fact, be hove to with the tide on the starboard bow, the wind on the port beam, and the anchor on the starboard quarter, the strain on her cable being eased by the counteracting influence of wind and tide.

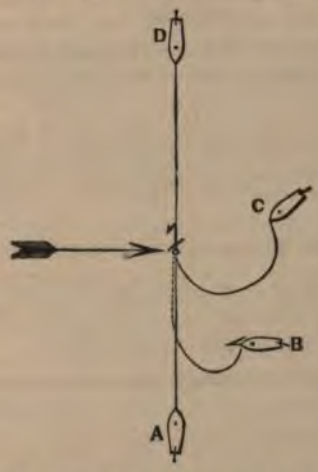
If the ship was not deeply loaded, of course, she would swing head to wind as the wind freshened. In these cases we suppose a *strong* tide and a heavy ship.

The ship being in the position E, when the tide slacks fill the head yards and put the helm hard a-starboard; as she swings into

the position F, right the helm, haul down the staysail and point the yards to the wind; she will then drop into the position G.

With chain cables, it would be impossible to keep them taut from the anchor, except with a very short scope.

TO TEND WITH THE WIND ATHWART THE TIDE.



Let us suppose the ship A to be riding to the ebb, heading north, the wind at west. As the tide slacks put the helm hard a-starboard, and she will gradually come head to wind, as at B, when the staysail must be hoisted and the sheet hauled to windward. This will tend to force her astern and clear of her anchor. Her stern will then cant at C, when the helm may be righted and the head-sails hauled down. She will finally drop into the position D.

If there is no wind, and she drifts over her anchor, then is the time to *sight it*, that is, to heave it up and see that it is clear.

The foregoing cases will sufficiently illustrate the theory of tending ship. Every officer should be familiar with it, for although we rarely take much trouble to keep the anchor clear, still the helm should always be used when necessary.

If tending ship be entirely neglected, the anchor should be sighted occasionally, and, if necessary, the second one let go while the first is clearing.

CHAPTER XXXV.

MOORING—CLEARING HAWSE.

MOORING.

IT must not be supposed that merely letting go two anchors, as in mooring, makes a ship safer. What, then, is the reason for doing so?

If a ship let go her single anchor (say in twelve fathoms), in the very centre of a harbor, which we will call about two hundred fathoms wide, and "steep to," all around, and then veer one hundred fathoms of cable, she would occupy every part of the harbor, as the wind or current happened to move her.

If it be desired to keep her stationary in the centre, shortening the cable in to twelve fathoms would not effect it, for the first puff of wind would cause her to start her anchor.

But let us ascertain from what quarter the prevailing heaviest wind blows; weigh, haul over, and let go an anchor in that direction one hundred fathoms from the centre; then, with a warp, haul the ship over in the very opposite direction, veering the cable two hundred fathoms from the last position, and then let go the second anchor. Now heave in one hundred fathoms of the first cable, veering one hundred on the last, and we shall have got the ship moored in a stationary position in the centre of the harbor; and many other ships (suppose room on each side), may share the harbor by similar means, as shown by the full-lined ships in Fig. 403, Plate 82.

Whether we moor with a whole, or merely half a cable each way, or lay the anchors out in any direction (so long as they are in opposite ones, and one cable is moderately taut before we let go the second anchor), is of no consequence as far as concerns the principle we are considering.

Now with regard to the direction. Say that the prevailing gales are northerly, and one comes on from that quarter so heavy that we should veer cable. If the other ships have attended properly to this contingency, all may veer simultaneously without fouling each other, and the riding cable of each ship will *grow* straight to their weather anchors; in other words, they will all have open berths and open hawse, as shown by the dotted line ships in Fig. 403.

PLATE 82

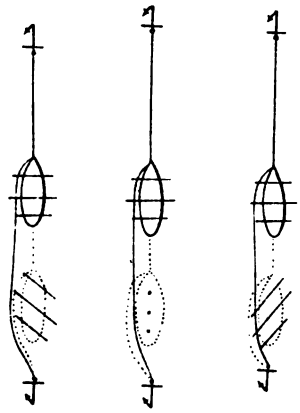


Fig. 403

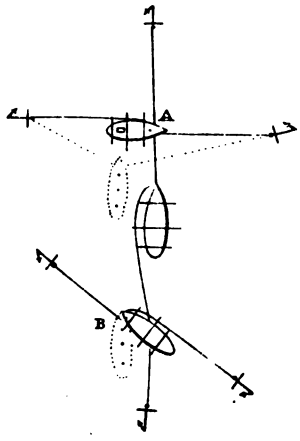


Fig. 404

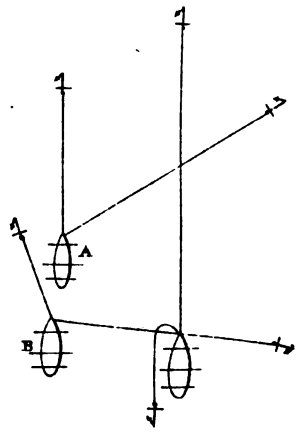


Fig. 405

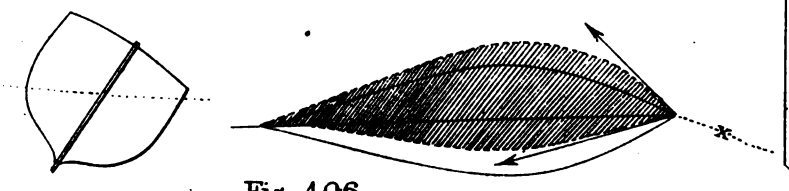


Fig. 406

MOORING.

It is clear that with a long scope of cable, we have all the additional weight of chain in our favor, that the ship's bows are less dragged downward than at a short stay, and the pull on the anchor being horizontal, the palm bites all the harder. When we wish to make the best use of our power, we must get as close to the resistance as possible. We do not want to move the anchor; and some officers prefer veering even as much as two cables on end to letting go other anchors.

Now suppose that one or both of the other ships had moored without regard to the position of our anchors and the direction of the prevailing gales. As long as the weather was fine, and we did not want to move, it would be of no great consequence, as shown by the full-lined ships in Fig. 404.

But we want to move. B has overlaid our south anchor, and we cannot pick it up. A has overlaid our north anchor, and we cannot pick it up.

Or it comes on to blow hard from the northward, and we want to veer; but B is in our way, and we must hold on until it pleases him to veer, and he, either from neglect or ignorance in thus mooring his ship, sees no distress.

A has swung close to our port bow, as in the dotted line ship, Fig. 404, his starboard cable is sawing at our weather one; both A and B, moreover, are riding on spans, and our ship and A see much distress.

At length we will suppose that B veers cable, and then that we and A veer; our new positions would be as in Fig. 405, and if a sudden lull or shift of wind occurred, the distress would be general. For we, as well as B, would have to wait for A, and B for us, before enough cable could be shortened in to keep the ships clear of each other.

Thus then it is, that, when the flag officer desires to have his ships as close together as possible, he orders them to moor; and to prevent collisions while veering or picking up their anchors, he points out the direction of the anchors. To preserve, likewise, an imposing and well-dressed line, he specifies the quantity of cable that is to be veered by each, and also enforces the use of buoys, that each ship may be enabled to ascertain the position of another's anchors.

These are some, but not all, of the reasons for mooring. For instance, in a river too narrow for a ship to swing in at single anchor without grounding, or too shoal to do so without striking on the upper pee of her anchor, and perhaps settling on it as the tide fell, it would be necessary to make her a fixture. But this also would require consideration. By laying the anchors out in

a line with the stream, they would be in the best position for holding, in the event of freshets or gales coming on, in concert with the tide; but, excepting the small distance she could sheer by the action of the helm, her exposure to collisions from an enemy's fire ships or rafts dropping down with the tide, or from vessels navigating the river, would be great; whereas, by having the anchors athwart the stream, either cable could be veered, and the ship quickly moved to one side or other. It is in such a case as the latter, that Porter's anchor is so useful; for, admitting of disconnection, it can be carried into shoaler water than the ship could reach, and greater scope of cable in consequence given.

The state of the hawse may be known by fixing two pieces of silk thread to the compass card in the direction of the anchors, and fastening their ends to some place above it. For every turn in the cables there will be found a corresponding one in the threads.

When it is optional, moor in northern latitudes with reference to the chances being strongly in favor of gales beginning at southwest, and ending at northwest.

For the same reason, in northern latitudes, lie at single anchor with the small bower (the port anchor), and if you have to let go a second, you will have open hawse. (Both bowers are now of the same size.)

Some officers prefer to drop the anchors *in a line* with the direction from which the gales are expected, instead of athwart, being supported in this opinion by the THEORY OF THE SPAN (page 243), as enunciated by Tinmouth, to which the attention of the student is particularly directed, others in a line at *right angles* to this direction.

In veering in a gale, the anchors being in the direction of the wind, the lee cable must be shortened in to prevent dragging it over its anchor: and there is some risk of tripping the lee anchor as the weather cable is veered. This is urged as one of the objections against this mode of placing the anchors, but the weight of authority seems to be in its favor.

A ship should never be girt by her moorings. At such a place as Panama, for example, where the rise and fall of the tide are very great, suppose a ship were to be moored and both chains hove taut at low water. The great strain brought on her by the rising tide, provided the anchors held, may be imagined; and if, in addition to this, she should swing around several times and foul her hawse, the effect on her copper and fastenings would soon tell.

MOORING.

PREPARATIONS FOR MOORING, STATIONS, ETC.

All hands having been called to "moor ship," the first lieutenant takes the deck, and the other officers repair to their stations as in "bringing ship to anchor." The officer of the forecastle will see hands by the anchor to be let go, and will give directions to those on the main deck as to veering, &c.

The navigator will see the second anchor ready for letting go, and the chain clear. Let us suppose that the starboard anchor was first let go, the port one must then be ready. He will see all clear for veering on the starboard cable, and men at their stations as in "coming to." When the starboard cable is veered as far as necessary, he will "bring to" on it, and unbitt the port one, for convenience in veering, unless in very deep water. The boatswain attends on the forecastle, and pipes as directed by the lieutenant in charge of the forecastle. The carpenter, with his crew, will ship and swifter in the capstan bars, put on gratings, knock up stanchions, &c., and report to the lieutenant in charge of main deck when ready. The gunner will see that the quarter-gunners stationed at the capstan to keep the messenger fair, &c., are at their stations; the sail-maker is generally stationed to attend to holding back the messenger. The nippers, selvagees, &c., must be gotten up, and if the messenger is not passed, the gunner will have it done. The navigator has a general superintendence over all, and will be held responsible for *everything* in connection with the operation.

The principal stations of the crew are, to man both capstans, to put on and take off nippers, to hold back and light forward the messenger, if one is used, to tend the messenger at capstan and capstan pawls, to veer cable, on deck at the wheel, the lead, signals, by the anchor, two men in each top, a man at each mast to attend braces, &c. Tierers below, compressor-men on berth-deck, &c., &c., &c.

HAVING ANCHORED WITH THAT VIEW—TO MOOR SHIP.

The first anchor having been let go in the proper position, and with reference to the state of the hawse to prevailing winds, the first lieutenant will inform the navigator as to the scope he wishes on each chain. The navigator will veer away to double this range (supposing an equal scope on each), keeping the last shackle *abaft* the bitts, for otherwise, supposing the chain well laid out, it would be mooring too taut. The mizzen topsail may be set, if necessary, and the ship sheered with it, and the helm, to the position of the second anchor. The chain must be laid well out

MOORING.

before the second anchor is let go; when that is done (the second anchor let go), the first lieutenant directs the boatswain to call "all hands to furl sail," and having furled them, will direct him to call "all hands to moor ship." The navigator will "bring to," and the first lieutenant then commands, *Heave round!* the stoppers are taken off (if any have been put on), when the cable is hove taut, and the chain is unbitted as it comes in, and payed below, if clean. Let us suppose that the port anchor was first let go, and that we veered ninety fathoms on it. The navigator is guided in veering the starboard cable by the amount hove in on the port; observing never to check her. Finally, veer the forty-five-fathom shackle halfway between the Mix-stopper and bitts, and heave in the forty-five-fathom shackle on the port chain, to the same place. They will then be convenient for clearing hawse.

If the swivel is to be put on immediately, the shackles had better be kept just *outside* of the hawse-holes, unless the swivel is so small that it can be passed through the hawse-pipe, in which case keep the shackle of the riding cable (the port one in this case) *inside* the Mix-stopper. In regard to the position of the shackles, it may be well to bear in mind, if in any doubt, that it is much better to keep them too far *inside* than the other way, as cable can be *veered* by two or three hands; but to *heave it in*, requires a deck tackle and all hands.

When intending to put the swivel on, the weather cable may be veered a fathom or so more than otherwise before the lee anchor is let go, as putting it on *slacks* the chain.

If a ship is moored too *taut* she may trip her anchors in case of a foul hawse, and the cables chafe the cutwater. If moored too *slack*, the swivel will not *turn*. The navigator should look at the state of the hawse every morning, in order to assure himself that the swivel is in good order.

A man-of-war lying at Valparaiso, in some fifteen or twenty fathoms water, and moored with the swivel on, was unable to clear the hawse and get her anchors, some time since. The swivel had not *turned* and no attention had been paid to it. The ship was finally forced to slip her chains and leave the anchors behind, to be weighed by an anchor-hoy.

When the ship is moored with the proper scope, the navigator will put on the stoppers, and report to the first lieutenant, who then directs the boatswain to "pipe down."

The vessel is now moored with a scope of forty-five fathoms on each cable, and will swing to the wind or tide, forming a sweep within her moorings. No vessel should be moored with cables

so slack, or with so little scope out, as to swing over her buoys or beyond her own moorings.

The foregoing example shows the proper course to pursue, when the spot to place the second anchor is directly to leeward of the first; but should that not be the case, she must be, by the use of hawsers taken out to the shore, or to another vessel; or by the use of a kedge, roused over to the proper spot, veering on the first cable while doing so. Then place the second anchor and proceed as just directed.

Should steam be up, of course, that would be used.

TO MOOR IN A TIDEWAY.

You may veer to the full scope (ninety or one hundred and twenty fathoms) any time during the tide, and drop the second anchor before slack water; for with a good scope of cable, and the current still running, you may give her a considerable sheer with the helm. After the second anchor is down, bitt and stopper the cable, and wait the change of tide; when, having swung to the second anchor, you may proceed to moor as before directed.

TO MAKE A FLYING MOOR.

This is one of those operations requiring great precision and promptness, where the failure in any one part must thwart the whole, and preclude the possibility of its proper performance. Attention is called to it, because it may be, and sometimes is, resorted to, observing also, that an officer should never subject himself to the possibility or probability of failing in any manœuvre, out of the common practice, where the failure may be owing to any other cause than his incapacity or want of judgment. It should never be attempted in a single-decked vessel, where there is not a separate deck to work the cables on.

This manœuvre is sometimes performed by officers, and with brilliant success, even in single-decked ships; but as a general rule, it is advisable never to hazard your professional reputation on the chances of any event so doubtful as to the satisfactory performance of this.

But to proceed: there are two methods of making a flying moor; in either case you have first to determine in what direction the two anchors should be placed.

First Method. Have everything in readiness for anchoring and mooring, a range of one hundred and twenty fathoms of one

MOORING.

cable, and sixty of the other, on deck; and, having made every preparation for shortening sail, approach the anchorage boldly. Clew up everything, and let go the first anchor while she has headway on sufficient to run out the whole range of one hundred and twenty fathoms. Then luff up into the wind, let go the other anchor, and proceed to heave in to an equal scope on each.

Second Method. Approach the spot where you intend to place the weather anchor, lay everything flat aback, and the moment the headway ceases, let go the first anchor, and veer to as she drops astern. Then clew up everything, and having run out the full scope of one hundred and twenty fathoms, stopper the cable and let go the other anchor. Bring to on the first and equalize the ranges. This is only proper when the places to drop the anchors are directly in the range of the wind.

In a very light air, the first anchor (in the first method) may be let go under all sail, clewing up the moment it is gone; but in a fresh breeze, and having much headway on, you should always clew up first.

When moored, a shackle should always be kept near the bitts, to facilitate the operation of clearing hawse, or for slipping in a sudden emergency.

As soon as the ship is moored, the *bearings* should be taken and entered on the log, together with the depth of water in which the anchors were let go, and the scope of cable out.

One of the first things to be attended to after mooring, is to bend the *sheet cable*, that the anchor may be in readiness for letting go, if necessary; and, being bent, take in the slack of it, and stop it to small bolts or staples in the side, so as to form, as nearly as possible, a straight line against the side of the vessel.

A neat arrangement for the sheet cable, is, to have that part of it which leads from the anchor to within the hawse-hole, of chain. The remaining part, whether of hemp or chain, to be kept below until the weather may make it necessary to get up a range. For the best method of tailing on a length of chain to a hemp sheet, see CABLES.

TO MOOR HEAD AND STERN.

As there are rarely any fitments for securing stern cables, we must take them to the mizzen mast, lash them to breeching bolts, in the bulwarks, or to the cradle bolts outside.

Sometimes the ends of the stern cable are secured on shore, the bight being on board; in this case, after veering away on

MOORING.

the bowers, and securing the stern fasts, heave a-head until moored taut enough. When using hemp cables or hawsers in this way, put plenty of good parcelling on in the wake of all chafes, and occasionally "freshen the nips."

Being at anchor, head to wind, and wishing to drop an anchor astern for the purpose of mooring head and stern, take the end of the stern cable, say the starboard sheet, aft out of one of the stern chain pipes, rouse it forward outside and bend it to its anchor. Now veer away on the bower, and let the ship drop to the berth of the sheet, when let go, heave in on the forward and veer the after cable to the desired scope.

Should four anchors be required, ascertain exactly the ship's berth when moored, and having carefully selected the position for each anchor (say the two bow-chains are to form an angle of sixty degrees with each other, the same with the after ones), mark them by small temporary buoys. Bend both sheets, leading from after chain pipes, have the anchors ready for letting go, and every preparation for mooring.

The use of a steam-tug greatly facilitates the operation.

Drop the first anchor in its berth, say the port bower, and veering away roundly, rouse the ship over to the berth of the starboard bower, and let it go.

Now veer away on both chains, get the ship astern over the position of the port sheet, and let it go; veer away on its cable, and lastly let go the starboard sheet. Bring to on the port bower cable and heave in to the desired scope, using a deck tackle on the starboard bower, and veering the after cables carefully. When in to the desired scope on all the chains, making due allowance for rise and fall of tide, secure for a full due.

Mooring in this way could hardly be well done where the bottom is muddy and soft, for it will be seen by constructing a diagram how much slack chain must be hove in, which would be almost impossible with the ordinary purchases after the chain had settled in the mud. This is particularly the case with the chain of the anchor first let go, which would be difficult to get straight on a moderately hard bottom, unless after very careful veering, and even then there is risk of fouling old anchors, rocks, &c., from its making such a sweep.

ANOTHER METHOD.

In order to save a great amount of extra work, heavy heaving, and the using up of purchases, the following may be

adopted: Let go the first bower, the port, as before, and having a heavy kedge planted in the proper direction—or by means of a steam-tug, get the ship over to the berth of the starboard-quarter anchor (starboard sheet), and let it go. This lays out in a straight line the port bower. Bring to on the latter, and heave in to the proper scope, veering carefully on the starboard quarter chain. The work is now half done; and, in so far as the chains are laid out straight, it is well done. The other two anchors may be planted by either of the following methods:

First. Send them out from the ship, one at a time, by means of a lighter, steam-tug, or boats (the latter method will be given hereafter), and let go in the proper positions. When both are so planted, clap deck tackles on the cables, get them suitably taut, and secure.

Second. Having the work half accomplished as before described, put a good slip buoy and buoy-rope on both chains (port bower and starboard quarter), unshackle inboard, and having made every preparation, slip them both, and haul over by kedge or otherwise to the berth of the starboard bower, let it go, and haul over to the berth of the port quarter anchor, let it go, bring to on the starboard bower, and heave in to the proper scope—or, in other words, repeat with the remaining two anchors, the first half of the operation. The ship being now in her central berth, she may, by means of the slip buoys, pick up her port bower and starboard sheet, and heave all taut to liking.

TO KEEP THE HAWSE CLEAR OR TEND SHIP WHEN MOORED—(TWO BOWERS).

When a ship is moored the sails are generally unbent, with the exception of the jib and spanker. With these two sails, the helm, and a knowledge of the principles of tending ship, an officer can scarcely go amiss. If the stern of the ship must go to starboard to keep the hawse clear, put the helm to starboard at the last of the old tide, and to port at the beginning of the new. This will have the effect of sending the stern to starboard and making her swing as desired. Use the spanker if it can be made effective.

A little attention in this matter on the part of the officer of the deck may save a great deal of work in clearing hawse. Should it be required to swing against the wind, use the jib.

CLEARING HAWSE.

A vessel moored, and riding by either anchor, having the cables clear of each other, "*rides with a clear hawse.*" If her head is in a line between the two anchors, so that the cables will each lead out from their respective sides, and clear of the stem, she then "*rides to an open hawse.*"

If, by swinging, she brings the cables to bear upon each other, so as to be chafed by the motion of the vessel, she has "*a foul hawse.*"

If, from having a clear hawse, she has swung half round, or performed a half circle, she brings "*a cross in the hawse,*" and that cable will be uppermost from which she swung. If it is the starboard cable which is uppermost, she must swing to starboard, if the port, to port, to clear the hawse.

But if she swings the wrong way, that is, continues the same way she swung before, performing another half circle, then there will be "*an elbow in the hawse,*" the same cable being uppermost. We will suppose that in both instances she has swung to port, then the starboard cable is of course over the port one, and she must swing to starboard to bring the hawse clear. Thus, from a *clear hawse* she has performed a full circle to produce an *elbow.*

The next swing in the same direction brings "*a round turn*" in the hawse.

And the next swing, "*a round turn and elbow,*" and so on.

An attentive officer will always endeavor to make his vessel, having a cross in the hawse, swing so as to clear it, by means of the helm or otherwise. But if she swings the wrong way, he should lose no time in resorting to the operation of clearing hawse by the cables.

A screw steamship, with steam up, can turn round with her screw and helm, and clear hawse in a short time. But the steam would not be up unless she was about to sail; and in that case she should clear hawse, unmoor, and heave in to a short scope while raising steam.

The hawse is *sometimes* cleared, when there is no wind and a smooth surface, by *towing* the stern of the ship round in the required direction. A *long* ship should never attempt it, and it is not a very seamanlike way of clearing hawse at any time. When hemp cables were used, clearing hawse was a long and tedious operation, as the splice of one cable had always to be drawn; but chain cables are readily cleared in the following manner:

CLEARING HAWSE.

Get up a deck tackle and the "clear hawse gear;" the latter consists of a stout pendant, fitted with a shackle or devil's-claw in one end, called the "clear hawse pendant;" a stout rope, fitted with sister hooks in one end, called the "veering rope;" a stout pendant fitted with a large hook in one end, rove through the bees; and a small hawser, rove through a block on the bowsprit, and intended to be used in taking the turns out, generally called a bowline. In small vessels the fore bowlines are used. The lee cable is the one to unshackle, and is called the "clearing cable." Lower the hook down through the bees, and allow it to catch under the riding cable, beneath the turns; haul it taut; this brings the turns above water. Pass the clear hawse pendant out of the sheet hawse-hole, shackle it to the clearing cable below the turns, haul it well taut and belay it; unshackle the clearing cable and hook the "veering rope" to the end; pass the bowline round the riding cable, following the turns of the clearing cable, pass it in the hawse-hole, and bend it to the end of the clearing cable. Send a boat under the bows. Haul out on the bowline, ease out the veering rope, and the bowline will take one turn out. The men in the boat will unhook the "veering rope," dip it and hook it again; then man it inboard and walk away. If there are more turns to be taken out, repeat the operation. As the clearing cable comes in, clap on the deck-tackle, walk away and shackle. Take off the bowline, clear hawse pendant, and finally, let go the pendant from the bees. Dry the gear and send it below.

Unless the chain is small, it is better to take out one turn at a time. If you have not a boat, let a man, in a bowline, dip the "veering rope."

In a frigate, or line-of-battle ship, the port watch always work on the main deck, and the other watch on the spar deck.

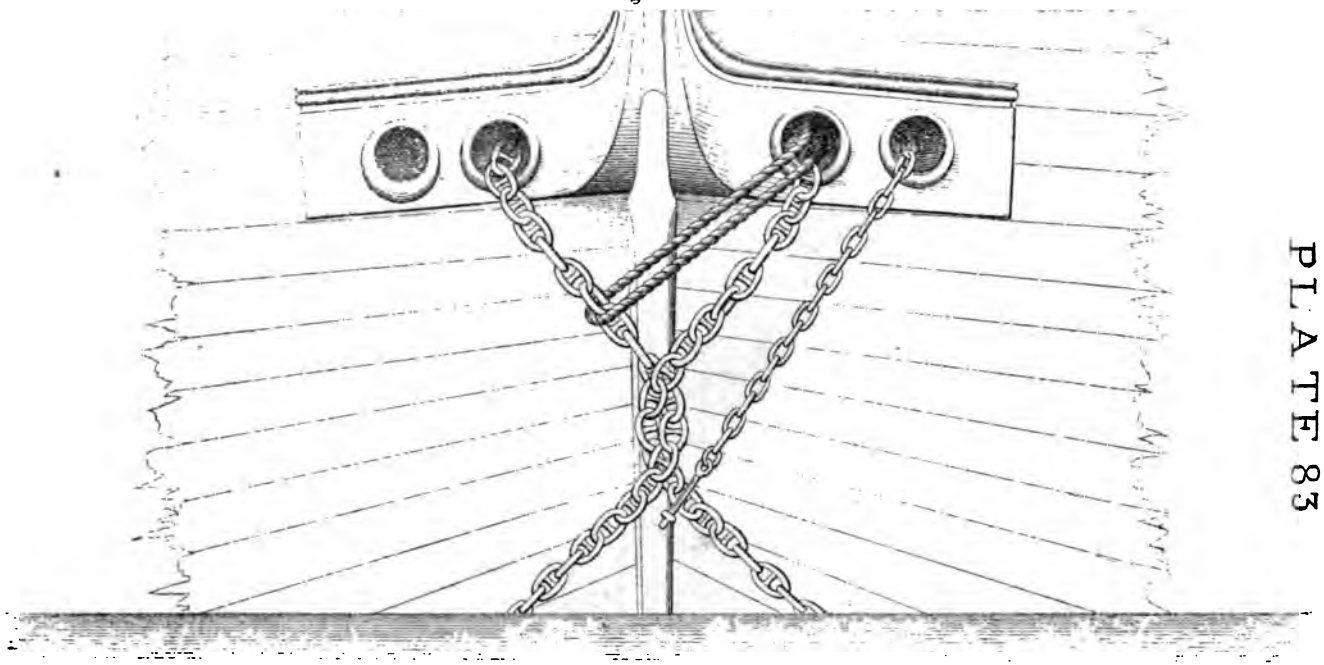
The cables are not *lashed*, unless the turns are so far below the water that the clear hawse pendant cannot be shackled. By clapping the deck-tackle on the riding cable, the turns can sometimes be hove out of water.

Do not unbitt the cable, but light it round the bitts to unshackle. A few fathoms roused up from below, and lighted round the bitts, well forward, may save the use of the deck-tackle altogether.

The Mix-stopper is screwed down before rousing up the chain to unshackle; and its use is limited to occasions of this kind.

When veering out, be careful to have a good turn with the "veering rope," so that in case the clear hawse pendant parts,

Fig. 407



CLEARING HAWSE OF AN ELBOW.

PLATE 83

CLEARING HAWSE.

the "veering rope" will hold the chain. An accident of this kind occurred once when clearing hawse in a 74, in consequence of which the chain was lost, but afterwards recovered by dragging. Always after, the end of a hawser was got up and bent to the clearing cable, below the clear hawse pendant, and *coiled down clear for running*, the idea being that, in case of the clear hawse pendant parting, they still had the hawser to recover the chain again.

It is not proper to attempt clearing by the riding cable, and it is always better to clear either at slack water, or as near it as possible.

NOTE. The pendant through the bees, with a hook in its end, is not always used. Some vessels use the *fish pendant* for the purpose.

TO CLEAR HAWSE.—(A SECOND METHOD.)

If the turns are under water, heave in on the riding cable.

When high enough, a slip-stopper shackled to the stream chain and passed out of the sheet hawse-hole is clapped on the lee cable, below the turns, and boused well taut. Veer the lee cable, and when slack unshackle it.

Pass the end of a hawser out through the hawse-hole, take it round the riding cable in the opposite way to the turn which has to be taken out; pass the end in again through the hawse-hole, and bend it to the end of the lee cable. Fig. 407.

Haul on the hawser and pay out the cable, assisting it, if necessary, by the fore bowline. The hawser will bring the end of the cable in again after the elbow is taken out.

Shackle the cable bowse to the compressor. Ease up the stream chain and take off the slip.

If there is more than one elbow, the hawser must be dipped round again.

If there is a cross in the hawse, the anchor having the undermost cable should be picked up first.

If the upper anchor was picked up first, it would hook the cable of the under one.

It is sometimes requisite to pick up the upper one, in which case unshackle, dip it and weigh.

In unmooring, pick up the lee anchor first; otherwise you may foul other ships or your own anchor.

MOORING SWIVEL.

TO PUT THE MOORING SWIVEL ON. (FIG. 408.)

By putting the mooring swivel on, the hawse is kept always clear.

The best time to put it on is at slack water, or as near it as possible. To do so, shackle the clear hawse pendant to the lee cable, as in clearing hawse, and haul it taut. Send a boat under the bows, with the swivel. Make fast a bowline from the bowsprit end, rouse out chain and pay the shackle into the boat; the men in the boat unshackle the chain and shackle it to the swivel.

Now put the clear hawse pendant on the riding cable, haul it well taut, unshackle the riding cable, veer it into the boat, and shackle it there to the swivel as we did the lee one.

If there is any doubt about the clear hawse pendant being strong enough, we must use a large hawser, or the stream chain, to secure the riding cable; and if the tide is running strong, or a fresh breeze blowing, it will be more prudent to postpone putting the swivel on the riding cable until slack water, or until the ship has swung.

When the swivel is on, it must be hove up clear of the water, and the chains middled, taking care, however, to keep the swivel clear of the cutwater.

The swivel is sometimes hove up close to one hawse-hole, and the other chain is then overhauled clear of the bows, or unshackled altogether. After the swivel is on, the two chains from inboard constitute what is called the "bridle."

Finally, take off the clear hawse pendant, &c., &c., &c.

The swivel should be put on with the *cup* upward that it may be more effectually lubricated.

If the swivel is so small that we can pass it through the hawse, hole, it can be put on with much less trouble. We have only to stopper the riding cable inboard, unshackle, put the swivel on and veer it outboard. Then send a boat under the bows and put it on the lee cable as just described.

English vessels have such large hawse-holes that a small swivel can actually be put on *inboard*, on *both* chains. The weather or riding cable having been unshackled, and shackled to the swivel, as just described; the clear hawse pendant is put on the lee cable and hauled taut; the *bight* of the lee cable, with the shackles, is then hove in the hawse-hole of the riding cable, alongside of the latter, unshackled, and shackled to the swivel. The latter is then veered out by the riding cable, and the lee

PLATE 84

Fig. 408.

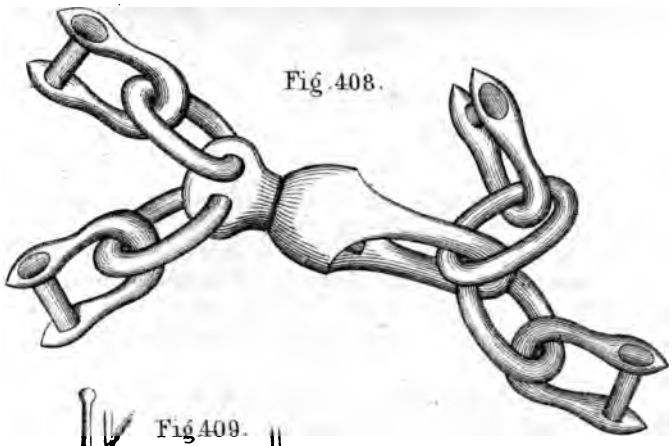


Fig. 409.

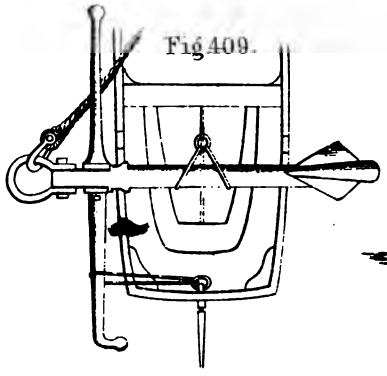


Fig. 412.

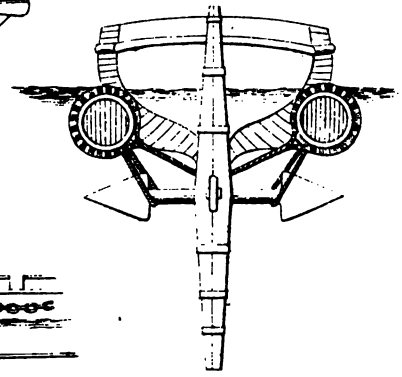


Fig. 411

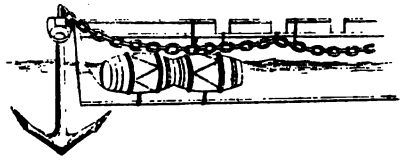
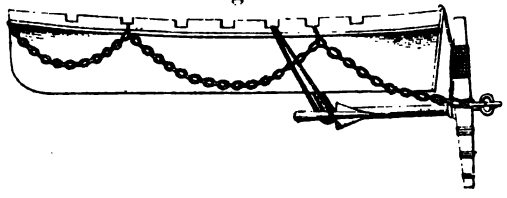


Fig. 410.



cable hove in as required. To effect this mode of putting on the swivel, the hawse-hole must be large enough to take *three* parts of the chain.

If intending to make a flying moor, and to veer to—say forty-five fathoms on each chain—the mooring swivel may be put on at the forty-five-fathom shackle before the weather anchor is let go (supposing of course, that the swivel will pass through the hawse-hole). As a general thing, however, it will give more trouble to do this than to put it on after the ship is moored.

HAVING ANCHORED BY THE STERN (PAGE 576,) TO HEAVE UP.

If the ship is still riding by the stern cable, heave in the bower, veer away the stern cable, set the spanker, and wind the ship. Hang the stern cable outside (or stopper it); pass a stout hawser out of the sheet hawse-hole; pass the end aft, outside of everything, and bend it to the stern cable at the nearest shackle, Unshackle, and let the cable go; man the hawser, and walk the cable in through the hawse hole. When taut in, clap a deck-tackle on it, take the bower cable to the capstan and heave round. Walk away with the deck-tackle as the bower chain comes in. When the anchor is up, unshackle the sheet chain, and haul it inboard out of the way.

HAVING MOORED HEAD AND STERN—TO UNMOOR SHIP.

If the stern moorings are made fast to the shore, we simply cast off the ends, clap on deck-tackles, and walk them inboard.

If we have moored with anchors astern, to unmoor, proceed in the following manner:

Let us suppose that we are moored with the two bower anchors ahead, and the two sheet anchors astern. Pass a good hawser out of the sheet hawse-hole, on each side; take the ends aft, outside of everything, and bend them to the stern cables at the nearest shackles. Have all clear for veering the bowers; unbitt them, and set mizzen topsail (aback), if the wind is light and ahead; stopper the stern cables, unshackle them at the nearest shackle inside the stern-port or pipe, and be ready to slip. Veer away the bower chains roundly, slip the after cables, man the hawsers, and walk the stern cables in through the sheet hawse-holes. Veer away the bowers, clap deck-tackles on the sheet cables, and heave them in. When near the berth of the starboard sheet anchor, slack the port sheet cable, and heave the starboard sheet "up and down," with the deck-tackle. Stopper

the bower cables, bring to on the starboard sheet, and heave it up with the capstan. Cat it, and then heave up the port sheet in the same way. Cat it, and bring to on the lee bower; put the deck-tackle on the weather one; heave round and walk away. When the lee anchor is "up and down," avast heaving, stopper the weather cable, and send all hands on deck to assist in transporting the sheet anchors to their places; when that is done, heave up the lee anchor, cat and fish it; heave in, or veer away, to the required scope on the weather cable, and "pipe down."

If, when mooring, it was found necessary to drop one (or both) anchors in water too shoal to float the ship, send the launch out to weigh it. Bring to on the cable, and when the launch has lifted the anchor clear of the bottom, heave round slowly, and bring the launch near the bows; she will then slip it, and it will be hove up.

TO WEIGH GUNS AND ANCHORS.

Having let go the four anchors, and thrown overboard the guns, as described in a former chapter, and wishing to weigh them, proceed as follows: Get up two deck-tackles, and stretch them along—say on the port side—ready to clap on the port sheet and bower cables. Clap a deck-tackle also on the starboard bower cable, and bring to on the starboard sheet. (We suppose that the port sheet was the *first let go.*) Take the hawser from the sunken guns over the bows, and in on the forecastle; let a few hands take in the slack of it, and keep it clear of the cables. Having clapped the deck-tackles on the port chains, send all hands to the capstan and deck-tackles (except those otherwise employed); heave round and walk away. If unable to man the *three* deck-tackles, take the starboard one off, and after heaving in the three cables fifteen or twenty fathoms, stopper the starboard sheet cable, bring to on the starboard bower, and heave in the slack of it. If unable still to man the capstan and deck-tackles in use, we must be content to heave in one cable on either side, heaving in fifteen or twenty fathoms, then stoppering and heaving in the other two. Work the cables on one side with the capstan, and on the other with the deck-tackle; as otherwise the messenger will have to be dipped (if a hemp one). In working cables in this manner, the *messenger* possesses advantages over the plan of taking the cable itself round the capstan.

When up to the berth of the guns, stopper all the cables. Bring the end of the hawser which is attached to the guns in through the warping chock in the bridle-port; clap a deck-

tackle on it, and heave the first gun up. Send the launch under the bows, and lower the gun in her, using the cat-fall if necessary. Cast the hawser off of the gun, and weigh the next gun in like manner. Drop the launch to the gangway, sling the gun and hoist it in with the yard-tackle and garnet. Continue this operation until all the guns are in, using the two heaviest boats to receive the guns (one at a time), and working forward and aft at the same time.

The guns might be got in the bow port, by means of the cat-fall; but as it would be necessary to lift them with the griolet-purchase, in order to mount them, the preceding method would be the better.

Boats could not be employed to weigh guns, thrown overboard in the manner described.

Having weighed the guns, bring to again on the cables, and weigh the starboard sheet anchor. Cast off the "backing hawser," take it in through the warping-chock, and weigh the kedge. Brace the foreyard up, send aloft a yard-tackle, hook on to the kedge, and land it on the forecastle. Bring to, next on the starboard bower, and weigh it and its backing kedge in the same manner. Weigh, next, the port bower and kedge; and, finally, weigh the port sheet and stream anchors (if getting under way). The stream may be brought to the capstan, to weigh it. The starboard sheet anchor must be transported to its place before we can cat the starboard bower.

The port bower, too, must be transported to the place of the port sheet anchor, before the latter can be catted. There would probably be no objection to doing this, as the anchors weigh about the same, and could be shifted the next time we come to anchor, by letting go the port sheet (bower), and then transporting the sheet anchor to its proper berth.

If there is any objection to this, we must ride by the stream after heaving up the port sheet to the bows; overhaul the port bower chain until it is *underneath* and clear of the port sheet anchor, and then let go the port bower and cat the sheet. Send the launch to weigh the stream.

Before letting go anchors, it is frequently necessary to run in the guns directly underneath them on the gun deck.

In the above cases of weighing anchors, &c., the vessel is supposed to be a frigate or seventy-four, though the *principle* is, of course, the same in all.

A vessel would perhaps be more than one day in picking up her guns and anchors as described, particularly if she has *swung*

UNMOORING.

and fouled her hawse. In such cases much time will be required to clear the cables and weigh the anchors. In case you are unable to clear the cables, the anchors must be weighed by the launch, and a hawser bent to that end of the chain, which will then be slipped by the launch, and hove in from the ship. No particular rules can be given for such cases.

When a ship has let go two or more anchors, in a gale, she should weigh her anchors *as soon as the gale moderates;* much trouble will be saved by it.

TO ASSIST THE MESSENGER IN HEAVY HEAVING.

Put a large viol-block on the cable, near the hawse-hole, reeve a hawser through it, belay one end to the mainmast or bitts, and clap a deck-tackle on the other end; or take it to the after capstan.

Put a strap on the cable at the water's edge, hook the cat to it, and assist in that manner.

Some vessels (brigs and small sloops) use the deck-tackle entirely in weighing their anchors.

In using a deck-tackle, particularly in a large ship, much time is saved by having a whip from forward to assist in *overhauling* it.

FOUL ANCHOR.

Should the anchor come up with the cable foul of the stock, hook on and cat as usual, surge, bitt, and stopper the chain, making sure there is enough slack chain outside for working. Now, by means of slew-ropes on the anchor stock, and slip-ropes on the chain, the turns may be cleared.

If not, hang the cable near the shackle to the cat-head, ease the anchor far enough down to slack it, unshackle, clear the turns, shackle again, get the anchor up, pass the cat-stopper, and unhook the cat.

If the anchor is fouled so that the cat cannot be hooked to the ring, then hook to a stout strap around the shank just under the stock, cat, and proceed as before.

Should the anchor come up crown first, hook the cat to a good strap on the crown, and "walk away" sticking out chain, until the crown is well up; then hook the fish to another strap on the crown, and walk away; when high enough, shift the cat to the ring, cat it, pass the stoppers, unshackle and clear the chain.

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The work should be relieved as much as possible of the weight of the chain, by hanging it by slip-ropes.

If the fish gear is not entirely trustworthy, cat the crown in the first place, hang it with the cat-stopper or the end of a hawser, then hook the cat to the ring before all, and the fish to the arm; ease down the cat-stopper, and capsize the anchor by hauling on the cat and fish at the same time. Now secure the chain, unshackle, and clear it.

For anchor work, where men are exposed to wetting, and sometimes get overboard, "clear hawse breeches" have been recommended.

Make them of painted canvas, roomy and wooden-soled at the feet, well roped and fitted with two spans long enough to clear a man's head when bent to a rope. In these a man can keep dry and work effectively and safely.

Too much importance cannot be attached to the manner in which cables should at all times be secured; and as a constant rule the riding cable should never be unshackled forward of the bitts.

Have all working of chains done at slack water if possible, as there is then less strain and less risk of breaking adrift.

Marking the anchor part of the cable so as to know exactly how much to surge for catting, saves noise and delay, and is therefore an important item, but due regard must be had to a foul anchor.

CHAPTER XXXVI.

GETTING ON SHORE—LEAKING.

WHEN a vessel strikes, the first step is to brace aback the sails, if on a wind; to clew up and furl everything if before the wind, and if under steam, to reverse the engine. It may be possible, if she has struck on a sand-spit or knoll, to force her over into deep water, otherwise she should be *hove off as she went on*. The navigator should be at once despatched to sound around the ship, and the boom-boats be hoisted out. Carry out the stream-anchor and bring the cable to the capstan. Have careful hands in the chains by the lead to watch if she moves. Heave round and try to get her off. If she does not start, move the guns and men as necessary to change her trim. If this fails, send out a bower anchor and chain. While the boats are carrying out the anchor, send down the upper yards and top-gallant masts, and prepare to start the water and provisions. If still impossible to move her, start water, heave overboard guns and shot (supposing there is no hope from higher tides), and all heavy weights. The guns should be carried clear of the ship and buoyed, with buoy-ropes strong enough to weigh them. Construct rafts out of spare spars, to carry provisions, water, &c. Of course, if small vessels can be procured they will be used. While lightening the ship a good strain must be kept on the cables by which the ship is to be hove off. This is very important, and every time the purchases are observed to slack up, they should be set well taut again. In case the anchor comes home, back it with the stream.

If a vessel is aground forward, shears may be raised over the bows, the heels resting on the bottom and the legs long enough to reach well above the bows; the object being to *lift* her by means of a heavy shear-head purchase. This method was once successfully tried with the United States sloop-of-war "Vincennes," but would not answer with any but the smaller class of ships.

Another instance is mentioned of a ship having run stem on very hard, and after unavailing efforts to get her off, hung on a rock abaft the foremast. All weights were run aft; balks of timber were placed athwartships forward of the place where the ship hung, and projecting through the ports; perpendicular

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shores were placed under these from the ground; stages slung to the balks, and wedges prepared for driving between their outer ends and the shore-heads. Opportunity was then taken of the first increase of water to set up the wedges, remove the after weights and heave in on the purchases at the same time. On this the ship started immediately; and, by a repetition of the same process of leverage, was completely cleared of the shore.

Vessels draw much less water when hove keel out than when upright or heeling over. It is related that a certain vessel had been driven so far up on shore, in a heavy gale and unusually high tide, as to be considered irrecoverable, and was sold for the mere value of her timbers; the purchaser floated a scow alongside of her at high water, and hove the vessel keel out by her masts, and then warped the pair into deep water.

If the tide commences to fall while the vessel is still aground, she must be shored up to prevent falling on her broadside. The spare fore and main topmasts may be used for this purpose. Weight their heels with kentledge, bend on guys to place them, and let their heads take beneath the fore and main chains. Should she rest too heavily on the spars, send out kedges to the opposite side, and bringing the hawsers to the mastheads, set them taut to steady her. At the next high tide try her again. If a steamer can be procured, let her tow in the direction you are heaving. If a ship is at hand to assist, she may anchor near, and, taking a hawser from you, heave at the same time.

When the vessel first strikes, and the sails are hove aback, or the engine reversed, the officer of the deck should send men in the lower rigging to shake the ship, sally from side to side, or move the guns aft quickly. These means often suffice to get the ship off.

If a ship bilges, all further efforts to get her afloat are of course abandoned. The first step in this case is to get the boats out and then to keep her upright, saving as much of her effects as possible.

Ships sometimes get hard and fast after grounding, from neglecting to lay anchors out *before* lightening. In some cases, the water close under the stern is too deep for anchoring. It is reported that the bower anchors of an English man-of-war, that had grounded in the St. Lawrence, were transported over the decks; and, being let go from the quarters with a purchase on each, which was carried to the bows, the ship was hove off.

H. B. M. steamer "Gorgon," of twelve hundred tons and three-hundred-and-twenty-horse-power, was driven on shore in a gale, near Montevideo, and imbedded in the sand to a depth of

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nearly twelve feet. Camels were constructed on the spot, tanks made water-tight by introducing fearnaught and lead within their lids. Boilers were hoisted out and made water-tight, and these, with casks, &c., affording altogether a buoyancy equal to three hundred and sixty-seven tons, were secured under the ship by means of cables passed round the bottom. These appliances, together with screws, and heavy purchases leading to anchors planted astern, being duly prepared, the ship, on the tide filling the dock that had been dug about her, was rescued from her perilous condition. "The whole operation presents a picture of united energy and skill to which maritime records afford no parallel." "The details of these operations have been narrated by one of the 'Gorgon's' officers as not only an account of the means used to restore the ship, but likewise to point out to the young officer to what advantages the qualities of perseverance and forethought may be applied, if duly cultivated in early life."*

The dimensions of one of the camels, whose buoyancy was equal to sixty-two tons, is as follows :

The planking was three-inch fir, doubled at the edges, and nailed on over seven frames, each nine inches by five.

Length	38	feet.			
Height	7	"	4	inches.	
Breadth at top	5	"	10	"	
" " bottom	10	"	4	"	

Cases have been related where officers have thoughtlessly given the order, on the ship grounding, to let go an anchor. The impropriety of this is obvious, for there is great danger of the ship striking on it and bilging. For the same reason when guns are thrown overboard, care should be taken that they be not placed where there is a possibility of the ship striking on them.

When a ship has touched lightly or run into soft mud, a moderate-sized anchor and hawser run out astern and hove taut, may suffice. Then all that is requisite is to loosen her in her bed. This may be done by running in the guns on one side, and sending all hands on the opposite side to list her; by letting the crew sally from side to side by the stroke of the bell, or, as has been successfully tried on board the practice-ships, by manning the lower rigging and causing the crew to shake together.

If badly ashore, be careful not to bring the heaving-off cables over the stern, so that they may have a tendency to *bear it down*

* Recovery of the "Gorgon," by Captain Key, R. N. This little work may be found in the Library of the Naval Academy, and is well worth reading.

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and press her heel on the bottom. Should both bowers be planted astern, bring the cables to the quarters outside, where hang them; now lash to them your heaviest blocks, say the cat, and toggle the fish block to the forward main deck port, also outside; reeve a hawser for a fall, and bring the hauling part from the cat in through an after port each side, taking one to each capstan, or use one capstan and a deck tackle. This gives a better lead.

SHIP ON SHORE WHERE THERE IS MUCH RISE AND FALL OF TIDE. WEATHER FINE.

Out boats and plant stream in best direction. Hoist out spare spars, and commence shoring up as rapidly as possible, as she will be left high and dry at low water. As soon as well shored up and spars lashed and cleated, ship all the ports and secure them.

Should it be a coral or rocky bottom, her safety will depend in a great measure on keeping her upright. Besides the spare spars take as many from aloft as possible; remove all weights from aloft, and run the guns in to a taut breeching. Get all weights from the side to the centre of the ship and lash them.

The finer the ship's bottom the more the danger to be apprehended from her heeling, and consequently the more the care required in shoring up.

If a full-bottomed ship, and one with a great deal of dead-rise, were both to get on the same rugged shore, the latter, supposing both to be kept upright, would stand the best chance, as she would rest on her keel alone, while the former would rest on her floor; if the two ships were heeled over and striking hard, the full ship would be in danger of bilging, while the sharp ship's lee side will be water-borne, and the ship striking on her keel.

Should both ships be left high and dry on "a hard" without shoring up, the full ship would be left nearly upright while the other would probably be lying on her beam ends. This is a critical position for a strong ship, but extremely dangerous for an old one.

In the matter of heaving off, the sharp ship, by taking the ground in fewer places and causing less friction, would give less trouble than one with a long, flat floor.

The foregoing remarks, taken in conjunction with those contained in the "Theory of Stowage" (pages 215–223), show the

importance of officers being familiar with the model, or "lines" of their ship.

LEAKS.

Water passes as the square root of its altitude; that is, if we suppose equal holes to be made in the bottom of a vessel at one foot, four feet, nine feet, and sixteen feet beneath the surface of the sea, the water will rush in the holes with a velocity equal to the square root of their respective depths. If for example, 1 represents the velocity with which it enters at the first hole, the numbers 2, 3, and 4, will represent the velocity with which it enters the others.

After the water has risen in a vessel, it will rush in all the *covered* holes with the *same* velocity, regardless of their depths, which velocity will be represented by the square root of the difference between the level of the water within and without the vessel.

Suppose a ship drawing twenty feet to spring a leak sixteen feet below the water line, or four feet from the bottom of the vessel. The velocity with which the water enters this leak is represented by 4; but when the water has risen in the vessel, say eleven feet, the water will then enter with a velocity $= \sqrt{20-11} = \sqrt{9} = 3$; when the water has risen sixteen feet, the velocity will be represented by $\sqrt{4} = 2$, etc. Hence it will be seen that although the pumps may not gain on the leak at first, yet they may do so after the water has risen inside the vessel above the leak.

In order to discover the locality of a leak, it is recommended to steer in different ways. If the leak increases when going ahead at full speed, it is probably forward, otherwise it is abaft. If it neither increases nor diminishes, it may be on either side; which may be discovered by going on different tacks.

Upon springing a-leak the pumps are at once manned and kept going. The carpenter then endeavors to discover it, and on doing so will stop it if possible from the inside. The hold or forepeak may have to be broken out for this purpose. Sometimes by listening attentively, the noise of the water rushing in will betray its locality.

If the leak cannot be got at in any other way, and is a dangerous one, a sail may be "thrummed" and placed over the hole from outside.

Sails are thrummed as in making a mat. They are got over the bows, and hauled close up over the opening by guys and

LEAKS.

tackles. The most expeditious way to thrum a sail is to pour on hot pitch, and then tread oakum over it.

Should the leak be on one side, and near the water line, the ship may be hove about or listed; when the carpenter may get at it and nail over sheet lead, or planking lined with fearnaught.

If in danger of going down, anchors, guns, &c., must be hove overboard, boats hoisted out, and rafts constructed for carrying men, provisions, and water.

No rules can be given for such cases. Much depends upon the example of coolness and energy set by the officers, and the general state of discipline. Much, too, depends upon the professional abilities of the principal officers, their practical knowledge and fertility of resource.

It has been said that "a good mariner ought to have all knowledge of carnal and worldly cunning, even to tailoring and shoemaking, that he may turn his hand to anything that may hap."

And it is told of Admiral Cochran, the late Earl of Dundonald—the Great Dundonald, as he was called—that upon one occasion when commander-in-chief of the Chilian navy, he pulled off his coat and with his own hands mended the pumps, when the water was gaining on the ship, his carpenter being incompetent to the task.

The student is referred for accounts of shipwrecks, for the various means of rescuing people from stranded ships, for constructing rafts, &c., &c., to the professional works with which the Naval Academy library is so generously supplied.

ASSISTING VESSELS IN DISTRESS.

In sending assistance to vessels in distress at sea, if the weather is bad, it is better to heave to to windward, and send off the boats; then run to leeward to receive them.

If there are many persons to be taken off, it would be well either to take the wreck in tow, or to lie on her quarter by a line fast to her. Persons then may be taken on board by means of a hawser.

Vessels-of-war frequently send their boats to the assistance of merchantmen, either to take off their men in case of wreck, or to assist them in getting afloat.

LEAKS.

Boats should be provided according to the necessities of the case.

Should the vessel be found to leak very badly, she may, if in the vicinity of land be beached, as a last resort; or, if near a harbor, be run in and put aground to keep her from sinking in deep water.

CHAPTER XXXVII.

CARRYING OUT ANCHORS BY BOATS.

To carry out a heavy anchor and chain is considered to be a somewhat difficult as well as dangerous operation. In 1842, a lieutenant and several men lost their lives while attempting it with a launch belonging to the U. S. steamer "Missouri," then aground in the Potomac river. This accident occurred in consequence of the chain being stowed in the boat. This should never be done if it can be avoided; and even when small anchors and hawsers are carried out, enough of the hawser (and a little to spare) should be hove overboard, before letting go the kedge, to allow it to reach the bottom. If, after letting go an anchor, the cable remaining in the boat should get away from you, direct the men to jump overboard at once, and hang on to the gunwale until the cable is all out.

Our launches and large cutters are generally fitted with a pipe or tube in the bottom for the purpose of reeving a stout rope through; this being taken around the arms of the anchor, the latter is hove up to the bottom of the boat by means of a windlass fitted for the purpose.

This method of carrying an anchor was first suggested by a Mr. Cow, of England. As there exists a great diversity of opinion as to the proper method of carrying anchors, the best English authorities will be quoted, premising the difference that the English boats are provided with two tubes or trunks, whereas our own have but one.

TO CARRY OUT A KEDGE.

Hoist the kedge out by the yard and stay, and lower it into the water astern of the boat. The coxswain hangs it there by a piece of two-and-a-half or three-inch stuff. One end of this is secured to the ring-bolt in the stern, passed around the shank just under the stock, and the end is belayed for slipping. Settle down the yard tackle and unhook. Bend the hawser and coil it away in the boat. When the kedge is to be let go, heave the remainder of the hawser overboard and slip the stopper.

A small kedge may be made much more effective by lashing big ballast or other convenient weight to it.

CARRYING OUT ANCHORS.

Circumstances will determine whether it is better to take the entire hawser in the boat, drop the kedge and bring the end back, or to "pay and go" from the ship.

TO CARRY OUT A STREAM ANCHOR.

In carrying the stream anchor out, receive it athwart the after part of the boat, Fig 409.

Hoist it out by the ring; when the crown is below the gunwale, hang it with a rope from the bottom bolt around the arms, and as it is lowered, bear the stock over the opposite gunwale, and bend the cable on under the stock after you have rolled the anchor aft. In this way you can steer, which you cannot when you place the flukes over the stern, with the stock resting athwart the boat on two fore-and-aft spars.

Moreover you can pull the after oars.

But with a short anchor you have no alternative. Therefore place the midship thwart across the stern, lay two capstan bars fore and aft, and land the anchor on this platform fore and aft, with the flukes over the stern.

It is well to fit the stream with slings, in which case it can be landed in its place across the boat without a moment's delay.

When likely to weigh a stream or other heavy anchor by boat, put a block on the crown, and reeve a double buoy rope through it before letting go.

CARRYING OUT AN ANCHOR BY A BOAT WHEN THE SHIP IS ASHORE (FIRST METHOD).

The readiest way to lay a bower out when it is too dark and too urgent to be bungling with bottom tubes and spar lashings over two boats is, "out boats, rig fish davit."

While the davit is being rigged, two large thimbles are seized into two straps, which are clapped round the outer arms of the anchor, and the end of a short buoy rope rove through them, which is stopped to the shank to keep it middled. A long pair of slings are put round the shank before the stock, and lashed to its upper end to keep the stock perpendicular. Round the shank also, and with its ends stopped up and down the upper end of the stock, is passed the bitt stopper, or some such piece of rope; hook the fish to the inner arm from aft forward; hook the cat to the stock slings, and ease the anchor down, keeping the shank horizontal and the stock perpendicular until it is about four feet

CARRYING OUT ANCHORS.

under water; bring the launch's stern against the stock; haul her side in close to the fish; secure the stock end of the anchor to the stern by the ring stopper, passing the turns through all the stern ring-bolts; bring the ends of the buoy rope in taut on each side through the rowlocks, and secure their bights through the foremost ring-bolts; ease up and unhook cat and fish; stop a length of chain round the boat outside, and then range as much more chain in the bottom as is intended to be carried out, stopping it in several places, and making the end well fast that it may not fetch away in veering. Fig. 410.

When about to let go the anchor, make sure by a cast of the lead that you have cable enough outside the boat to reach the bottom, and hang it well to the stern that no more may run out. If there be a greater quantity of chain in the boat than can be ranged in one layer, there will be damage done unless you disconnect at the first shackle and bring it to the last one, which will be the upper one of the range paid down. Let go the anchor with the boat's bow *from* the ship, either cutting or slipping all its fastenings together. Lash a capstan bar athwart the stern; lay the cable over it and veer away cautiously fathom by fathom. If the end of another cable is brought to you, join it; hang the joining shackle outside your boat, and throw the bight out, letting both parts hang from the stern *over* the bar—that is to say, have no cable now remaining in the boat, and when all is clear, slip the bight.

This proceeding will suggest the necessity of always taking punches, shackle-pins, and hammers in a boat, when setting out on an anchor expedition.

CARRYING HEAVY ANCHORS BY BOATS (SECOND METHOD).

When the boat is unequal to the weight, sling four empty butts in pairs, marrying their slings, and "snaking" them, so as to prevent them from being shaken off. Bung the casks well, weigh the stern of the boat, and bear the butts underneath. This will increase the buoyant power of the boat about two tons. With a large launch prepared in this manner, the anchor may be lowered, and hung with its stock horizontally across the upper part of the stern as in *fig.* 411, and a whole cable carried out. Of all methods this is certainly the quickest, and moreover the boat will tow more easily than with the anchor entirely under her bottom.

If the anchor were too heavy to admit of its being carried in this manner, its flukes must be hove up under the bottom, and the stock secured in the perpendicular, as in *fig.* 412.

CARRYING OUT ANCHORS.

In lowering the waist anchor by the tackles *into* a boat, hook the main tackle on the inner arm, and the fore tackle inside on the lower stock, so as lay it with the stock athwart ships.

LAYING A BOWER ANCHOR OUT BY THE LAUNCH (THIRD METHOD).

Rig the fish-davit; sling the flukes with a span formed of two stout pendants; hitch one round each arm of the anchor as it lies on the bill-board, close up to the palms, and splice a long eye into the other ends (all of which can be done while the davit is being rigged); nail a couple of cleats, to form a fork, on each end of a small spar, or oak plank, about eighteen inches longer than the beam of the boat amidships; place this in the span, allowing sufficient drift for the boat to pass between it and the anchor; toggle the eyes of the span together with a large toggle, fitted with a stout laniard, and seize each end of the stretcher to the span, to prevent it slipping down when the anchor is lifted.

Hook the fish to the span, and the cat to the ring of the anchor. Pass a strap round the shank, and lash it up to the upper stock, leaving the bight above the lashing just long enough to come in over the boat's stern. Cut the gunwales down, midway between the two after-thwarts, to receive the stretcher (which scores may afterwards be fitted with shutters to be ready for future use on a similar occasion). When a span is not used, the lashings for slinging the anchor should cross inside the boat, to frap the sides together. Haul taut cat and fish, slack up ring-stopper and shank-painter, and ease the anchor down. The moment it is low enough, the launch hauls up, stern foremost, passing through the span, and bringing up with her stern against the stock. The slip-rope is rove through the ring-bolts in the stern and keel, lashed down and well parcelled in the wake of the latter one; the ends are knotted, and the bight is toggled to the bight of the strap on the stock. The stretcher is then lashed down to the boat, and the cat and fish are unhooked.

Connect both toggles by the same laniard; form an eye in the bight, by crossing and seizing both parts together, so that a jigger from the bows of the boat, hooked to it and hauled on, will bring an equal strain on each part. Meanwhile, the cable has been stowed in the other boats, and stoppered at frequent intervals; and a cutter has been despatched with a kedge and hawser for them to warp up by, taking with her a deep-sea lead-line from the ship, to regulate the distance. The kedge should be placed well ahead of the position in which the anchor

CARRYING OUT ANCHORS.

is to be dropped, otherwise it will come home before the launch gets there: then return on board with the hawser. Pass the warp into each, let all hands clap on, warp up and pay out the cable to the bottom as you go. If each fake is stoppered to a thwart or ring-bolt in the boat as it is coiled away, there will be no danger of its taking charge when you pay out.

As soon as you have warped up to your position, and all the cable is payed out, man the jigger, have a sharp axe in hand, in case of anything holding, stream the buoy, and "One—two—three—let go!" Weigh the kedge, and return on board.

It is often very important, in laying out anchors, to stop the buoy-rope to one pea, and stopper it short of the drift, and so cant the anchor at once for biting.

As chain cables are nearly twice and a half the weight of corresponding hemp ones (being in the proportion of 16.4 to 6.7), the latter should be used in preference when it is necessary to lay out upward of seventy or eighty fathoms, or in bad weather, when any considerable load would endanger the boats. Otherwise, chain has the advantage, it being so much more easily handled, and more trustworthy among rocks.

If you hold on the cable till the anchor is let go, and then pay out as you return on board, you must first ease down sufficient to reach the bottom, or the anchor, on being let go, will take the boat with it. For this purpose, a bight of chain is usually stopped round outside the boat, ready for dropping; and if this is not enough, more must be payed out. If you have to warp out against the wind and sea, lay the cable down on your return; if before it, pay out as you go.

The trunks fitted to boom-boats may be of great service in weighing a heavy anchor, but are not to be thought of in laying one out.

With a heavy wash under the bows, so that the launch could not lie under the cat-head with her stern forward, the anchor must be cock-billed, the cat hooked to the span, and the fish to the ring, the cat-head stopper eased up, the anchor squared with the flukes forward, and the launch veered aft by a boat-rope from the jib-boom end, steadied, if necessary, by a whip from the fore yard-arm, braced forward.

Should you find, on easing down, that the boat will not carry the anchor safely, take the weight of it again, and lash as many water-casks under the bilge as you think will be sufficient (the buoyancy of a butt being eight cwt., and that of a puncheon upward of five).

CARRYING OUT ANCHORS.

It must be borne in mind that the weight of an anchor in the water is less than what it is out of the water, by the weight of water that it displaces. The specific gravity of wrought iron is 7.788, and of salt water 1.026; therefore, the specific gravity of iron in relation to water—7.788 ÷ 1.026, is 7.59. A ninety-gun ship's bower anchor weighs 95 cwt. with the stock; but, as the oak and hoops are, as nearly as possible, of the same density as water, the stock—5 cwt.—need not be taken into consideration. Consequently, the weight of the anchor, minus the stock, divided by 7.59, gives the decrease of weight when the anchor is submerged—in this case equal to 11.86 cwt.

Or, the decrease of weight consequent on the immersion of a body may be found by calculating its cubic contents, and then ascertaining the weight of its equivalent bulk of water.

90 cwt. = 161280 oz., which, divided by 7788 (the specific gravity of iron reduced to the same standard), gives a quotient of 20.7, being the cubic contents of the anchor in feet. Now, a cubic foot of salt water weighs 64.2 lbs.; and, therefore, 20.7 cubic feet weigh 1329 lbs., or 11.86 cwt., as before.

LAYING SHEET ANCHOR OUT BETWEEN TWO BOATS IN HEAVY WEATHER, BACKED WITH THE STREAM (FIRST METHOD).

Hoist out the first and second cutters or the launches; send one away to run out a kedge, and, in the meantime, get the stream anchor and part of the stream chain cable into the other. To the stream cable lash a block, large enough to take a seven-inch hawser, at a distance from the anchor equal to about twice the depth of water in which the anchor will be let go. Reeve and middle the hawser, and pass both ends inboard. Warp the boat out by the kedge, and let go the stream anchor well in advance of where the sheet is to be dropped. Leave the third cutter to buoy up the cable when the block is lashed and come on board.

While this is being done, the yard-tackles have been got up, the anchor slung and lowered down square, stock athwartships. Two spars being prepared, the boats' gunwales are cut down amidships where the foremost spar lies, and the aftermost spar is lashed across the sterns. The boats being hauled up on either side of the anchor, it is slung with a long strap round the upper fluke, passed over the foremost spar, and toggled to a strap, round the shank abaft, which is passed over the after spar; and the stock, lying across the sterns, is lashed to each boat to keep it steady. The seven-inch is then made fast to the boats, and

they are hauled out on board the ship to where the third cutter is buoying up the stream cable. This they take in, and send the cutter back with the end of the seven-inch. When they get hold of the hawser on board, it is bent to the end of the sheet cable (the ganger being unshackled); then the hawser is manned, and the cable hauled out to the boats and shackled to the anchor. The stream cable is then hitched round the shank, and seized, and allowed to slip down to the crown; the stock lashings are cast off, and the anchor is let go, with the ring toward the ship, by a jigger on the laniard of the toggle.

If the anchor is laid out astern, you may bring the cable itself, in this class of ship, to the capstan; and use the sail-tackles, fleeted alternately, to haul back upon.

TO CARRY OUT AN ANCHOR BY TWO QUARTER-BOATS, AS PRACTISED BY CAPTAIN CRAVEN ON BOARD THE U. S. SCHOOL SHIP "PLYMOUTH" (BEING A SECOND METHOD WITH TWO BOATS, THOUGH SIMILAR IN PRINCIPLE TO THE LAST).

The two boats were brought alongside each other, with their sterns abreast, and separated about three and a half feet; two spars were laid across their gunwales and lashed to the thwarts, with two lashings around each thwart.

The forward spar was a little forward of the centre of gravity of the boats, and the after one about seven feet abaft the forward one.

A large fish was laid across from one stem to the other, on which was placed a temporary warping chock, for the hawser used for hauling out the boats.

The stream anchor was hung to one of the spars, by a stopper long enough to lower the anchor to the bottom, and a top-block large enough to take the hawser was hooked to the ring. A hawser was coiled away in the stern sheets of each boat; the upper end of the port, rove through the top-block, and bent to the upper end of the starboard one. The two boats were then towed out pulling their outside oars, and when a cable's length off the stream was *lowered* to the bottom. The boats then dropped back to the ship, taking care to keep the hawser and top-block clear.

When under the bows the port hawser was made fast to the fish athwart the stems, and the starboard one passed in the hawse hole.

The boats were then dropped so as to bring the forward arm of the anchor (a-cockbill at the port cat-head) between the boats.

CARRYING OUT ANCHORS.

and abaft the spars, the anchor hanging with its stock athwartships.

A piece of three-inch rope (anchor weighing five thousand pounds) was then secured to the forward spar, and four turns passed around the forward arm of the anchor and the forward spar, the lashing passing under the after spar.

The anchor, being lowered by the cat-fall, until the strain was brought upon the lashing, hung with its stock near the gunwales of the boat, and its flukes under the bottoms, and was so hung by a hawser from the cat-head, while the cat purchase was unhooked.

By means of a rope's end on the outer end of the stock, the latter was brought perpendicular; the ring was then lashed to the after spar, the hawser from the cat-head eased, and the anchor left suspended from the two spars, the flukes under the bottoms of the boats, and the stock perpendicular and close up to the after spars.

The bower cable, shackled to the anchor to be carried out, was unshackled at the first or fifteen-fathom shackle, and the end buoyed with a rope strong enough to weigh the chain.

The warping hawser was then manned inboard, and the boats and anchor hauled out to the position the latter was to be planted, towing the fifteen fathoms of chain astern.

When ready to let go, both lashings were cut at the same instant with sharp axes.

Being released from the spars, one boat brought back the standing part of the hawser, from the stream, took the end of the chain in her bows, securing it there with end enough to shackle, hung a bight to her stern, and was hauled out again by the hawser from on board. When the chain began to drag, the other boat was brought under the bows, and a bight hung to her bow and stern in the same manner.

On reaching the buoy-rope, the first boat weighed the end of the chain, shackled the two lengths together, and both boats slipped the bight together.

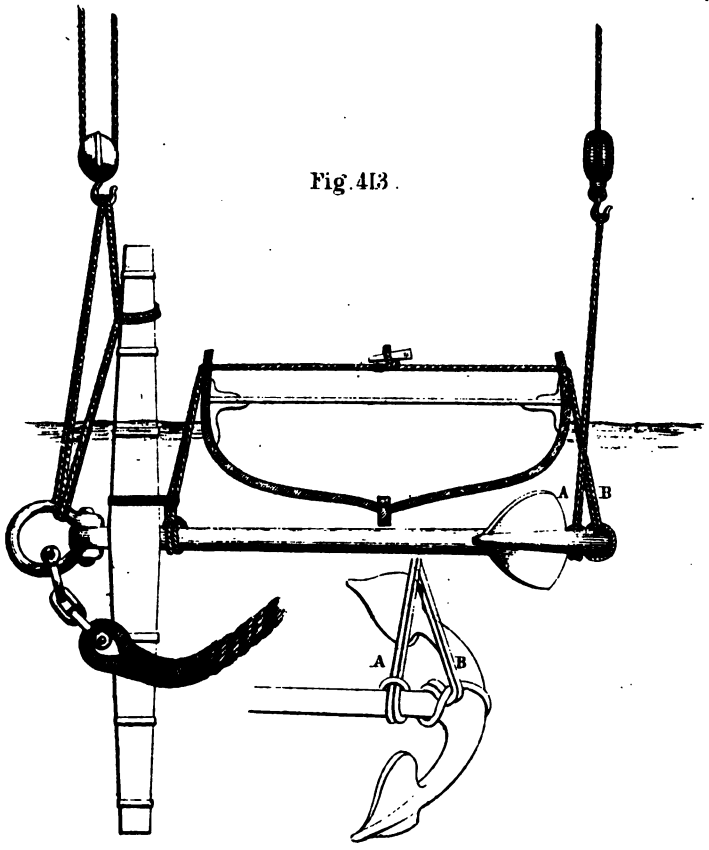
If the boats cannot carry out more than one length at a time, the whole cable may be carried out by lengths in the same manner, buoying the end each time.

The anchor was carried out and dropped in four fathoms water; no accident occurred, and the whole operation was performed in a short space of time.

PLATE 85

LAYING OUT AN ANCHOR

Fig. 413.



CARRYING OUT ANCHORS.

TO SLING A LARGE ANCHOR UNDER A LAUNCH (FOURTH METHOD). FIG. 413.

Prepare four four-inch straps; two for lowering the anchor, two for securing it under the boat.

The two for hanging the anchor are rove on the bight, one round the crown and the other round the shank close to the stock, and lashed to the upper arm: bend a hauling line to the end of each and let them hang down toward the boat.

The two for lowering the anchor are secured, one to the ring and the other to the shank, close to the crown. Hook the cat to the ring strap, which is first hitched round the outer arm of the stock to cant the anchor square, the fore yard tackle to the strap on the shank, and the fish to the inner fluke. Brace the fore yard forward, top up, and secure it as for hoisting a boat in. Haul taut the cat, fish, and yard tackle. Let go the shank painter. Ease the anchor down by the cathead stopper until the cat has the weight. Let go the cathead stopper, and lower of all.

When at the water's edge, let go and unhook the fish, allowing the cat and fore yard tackle to have the weight. Lower away. Haul the boat over the anchor, head to the sea, the shank lying athwartships under the boat. Pass the two straps for hanging the anchor in through opposite rowlocks, as near amidships as possible, toggle one bight through the other, putting a spunyarn seizing on the eye to insure the toggle from slipping. Ease up, and unhook the cat and fore yard tackle.

If the anchor has been slung under the boat for exercise, the straps can be fitted the exact length—the anchor being as close to the boat as possible, allowing for a heavy sea. A jigger is hooked to the laniard of the toggle, which is greased.

When ready for letting go, man the jigger and slip the toggle.

The stock of the anchor being up and down on one side of the boat will prevent the boat being steered straight ahead, but this does not matter if the kedge anchor is laid out to haul the launch off to.

When a ship is on shore forward, unless a launch is fitted with trunks amidships, a large anchor cannot be carried out slung in any position under the boat, on account of the depth of water.

CARRYING OUT ANCHORS.

TO SLING A LARGE ANCHOR BETWEEN TWO BOATS IN SHALLOW WATER. (FIG. 414.)

Hook the cat and fish; the cat to the ring, and the fish to a strap round the crown. Put a short strap round the crown, one bight being rove through the other, and a thimble seized in for hanging the anchor by. Haul taut the cat and fish, let go the anchor stoppers, and lower the anchor down nearly to the water's edge. The boats haul up, each having a good stopper for hanging the anchor. The headmost boat secures the stopper to the ring bolt in the bottom of the boat, passes it over the stern roller, through the ring of the anchor, over the roller in the end of the stern davits and secures the end to the luff tackle, which is hooked to the bow ring bolt. Bowse the tackle well taut and secure. Ease up and unhook the cat.

The second boat hauls up bow first, secures her stopper to the ring bolt in the bottom of the boat, passes it over the bow through the thimble in the strap on the crown, in over the other bow and secures the end to a luff hooked to the after stern ring bolt.

Bowse taut the luff, secure and ease up the fish.

To let go. Ease the anchor down clear of the boats with the luff tackle, then slip the ends of the stoppers together.

Unless fitted with chain slips, there is danger of one stopper slipping before the other; therefore, warn the men in both boats to be careful.

Either boat will carry out a considerable quantity of the cable in the opposite end.

TO CARRY OUT AN ANCHOR OR GUN BY MR COW'S METHOD.

The object is to bring the weight of the anchor on that part of the boat most capable of bearing it, and to use a purchase in the boat equal to the heaving up of any weight that she can sustain.

This is accomplished by suspending the weight by a rope passed through a hole or holes in the centre of the boat's bottom, a tube placed over the hole preventing the water from filling the boat.

Mr. Cow used two holes and trunks—Fig. 416—our boats having but one. This simplifies the construction, while it does not change the principle.

PLATE 86

LAYING OUT AN ANCHOR IN SHALLOW WATER

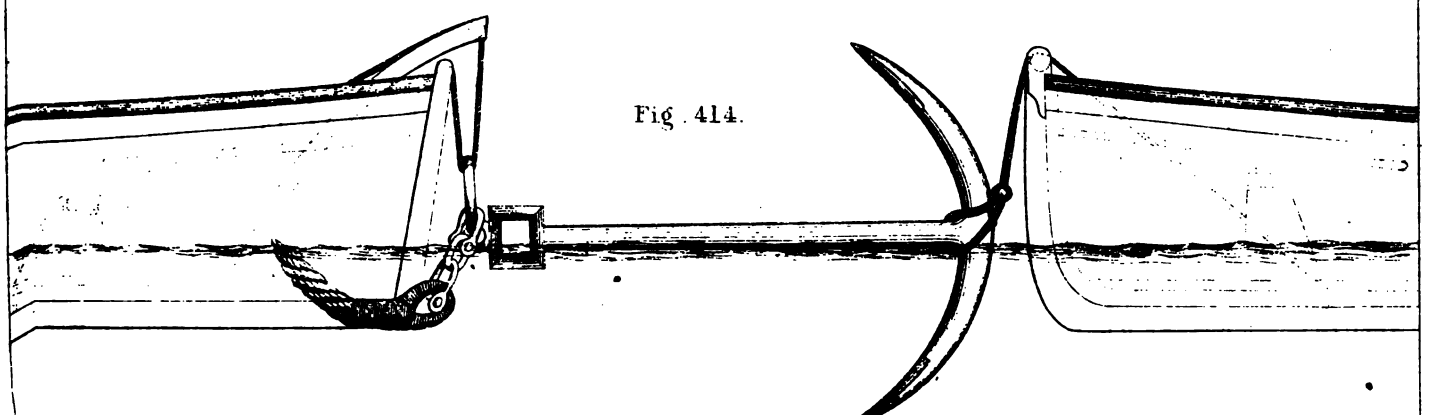


Fig. 414.

PLATE 87

Fig. 415.

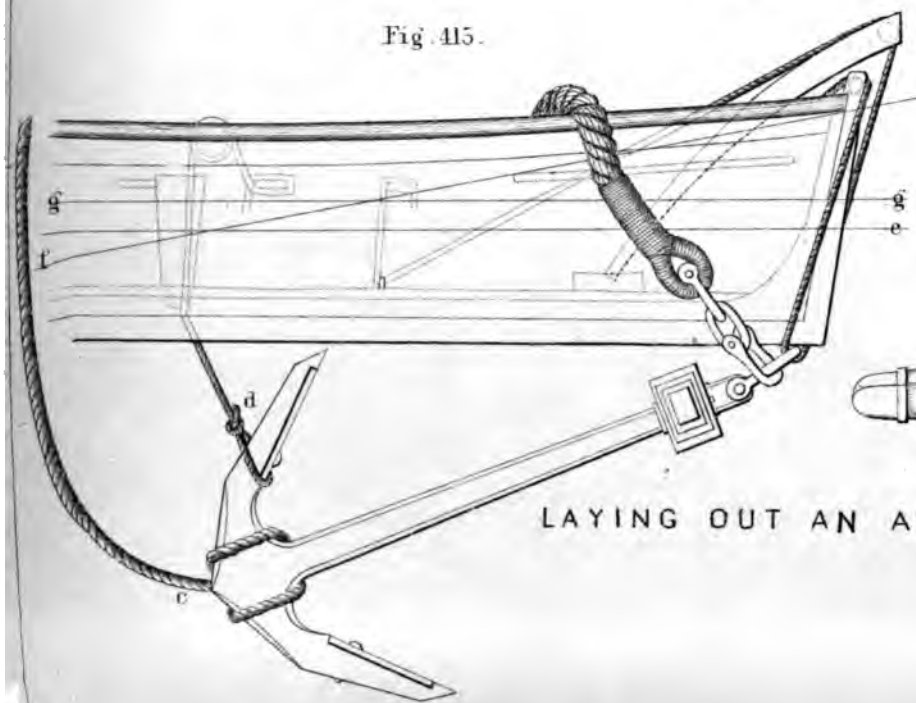
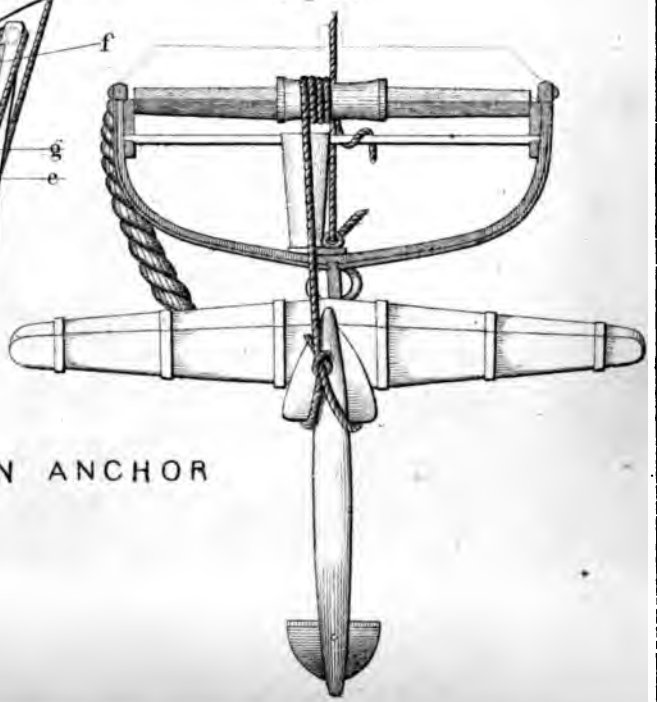
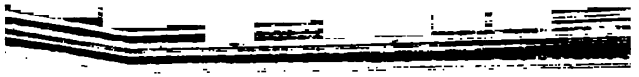


Fig. 416.



LAYING OUT AN ANCHOR



In the hole is secured a brass screw-tap, over which screws a copper funnel. When preparing for use, screw on the funnel, or trunk, as it is sometimes called, and unscrew the "tap;" as soon as the latter is off, the water flows in, rising in the trunk till level with the water outside the boat.

Immediately over the trunk is placed the windlass, the gudgeons in its ends working in bearings on the gunwale.

A 74-gun ship's launch measures..... 20 tons.
A frigate's " " ..... 15 "

	Tons.	Cwts.
A 74's anchor weighs.....	3	16
" cable (22-inch hemp) weighs.....	5	2
	8	18

Therefore, a launch can very well carry out an anchor and hemp cable.

If a chain cable be used, other boats must be employed to assist in carrying it out.

Fig. 415 represents a first-rate's launch, with a bower anchor suspended under the bottom, and a hemp cable coiled away in the boat; *c* is the buoy-rope; *d* the rope by which the anchor is hove up; *e* the line of flotation when the vessel is light; *f* the line of flotation with bower anchor hung in the ordinary way to the stern; *g* the line of flotation with anchor hung as represented, a cable and twenty men in the boat.

Besides being fitted with two trunks, English launches are supplied with davits for weighing anchors; but, in general, the rollers in the bow and stern of our launches will be found sufficient.

TO FIND THE NUMBER OF CASKS REQUISITE TO CARRY OUT A 95-CWT. ANCHOR.

A butt holds 110 gallons, and an imperial gallon of distilled water weighs 10 lbs.; therefore, $110 \times 10 =$ the floating power, 10 cwt. nearly.*

The weight of the casks themselves need not be considered, as when they are submerged, it is inappreciable. The anchor, as has been shown, loses nearly 12 cwt. by immersion; and as the weight of the stock—5 cwt.—is not felt, eight butts should be sufficient to support it, though ten would be safer.

* The standard gallon in the United States weighs 8.338 pounds.

CARRYING OUT ANCHORS.

A spar (spare jib-boom) would be required to secure the casks to. They should be whipped over, ready slung, and placed at each end and in pairs on each side of the spar, leaving the centre clear for the anchor. Hang it by the ring, with a small lashing round the spar and ends of the stock, to keep the latter fore-and-aft. Cast these off before letting go. If the water be very shoal, or circumstances otherwise unpropitious, it may be necessary to sling the anchor flukes forward, in which case it will be hung by two lashings instead of one—a disadvantage when the operation of letting go is performed by an axe.

To calculate the Capacity of a Cask. Multiply half the sum of the areas of the two interior circles, viz., at the head and bung, by the interior length, for the contents in cubic inches; which, divided by 277.27, the number of cubic inches in a gallon,* reduces the result to that measure.

Supposing that the casks at your disposal measured 21 inches in diameter at the bung, 16 inches at the head, and 28 in length; then 346.4 and 201.1 would be the respective areas, and their half sum, 547.5, multiplied by 28, and divided by 277.27, would give 27.65 gallons for the contents, which is the capacity of a beef-barrel.

To ascertain the Number of Four-foot Tanks requisite to carry out the Same Anchor. The cubic contents of the tank being sixty-four feet, and a cubic foot of (distilled) water weighing 1,000 oz., or 62½ lbs.; $64 \times 62.5 =$ floating power, minus the weight of the tank (which in water would be about 6 cwt.), or 30 cwt. nearly. Three tanks, therefore, would be the number required.

To calculate the Floating Power of Spars, for the Same Purpose. Try the three spare topmasts; the main being sixty-four feet long (exclusive of mast-head), diam. 22 in.; fore, 57 ft., diam. 22 in.; mizzen, 45½ ft., diam. 17 in. The weight that they will sustain, is the difference between their own weight and that of the water they displace.

To ascertain the weight of a spar: multiply the square of the diameter by .7854 (the area of a circle whose diameter is one inch), to find the area; multiply the area by the length, to obtain the cubic contents; and the product by the weight of a cubic foot of the material, ascertained by experiment.

Main topmast.—The greatest diameter being twenty-two inches, the proportion of diameter at first quarter is $\frac{20}{21}$; second quarter, $\frac{20}{21}$; third quarter, $\frac{8}{9}$; equal to 22 in., 21.6 in., 20.9 in., and 19.5 in., respectively; consequently twenty-one inches is the mean diameter.

* The standard gallon in the United States is equal to 231 cubic inches.

SWEEPING FOR ANCHORS.

64 ft.=768 in., and $21^2 \times .7854 \times 768 \div 1728$ (the number of cubic inches in a foot)=154 cubic feet.

Fore topmast—57 ft., in like manner gives 137 cubic feet; and

Mizzen topmast—45.5 ft., with a mean diameter of 16.2 in., is equal to 65 cubic feet.

Total 356 cubic feet.

356×64.1 (the weight in lbs. of 1 cubic foot of salt water).....	= 22819 lbs.
356×36.3 (the weight in lbs. of 1 cubic foot of Norway spars).....	= 12923 "
Floating power of spars.....	9896=88 cwt.

SWEEPING FOR ANCHORS OR CHAINS.

When an anchor and chain have been lost, the attempt should be made first to catch the chain, and failing in that, the anchor itself. The position of the anchor is known by the cross-bearings taken when the ship anchored—also the direction of the chain. To sweep for the latter, let the boats pull at right angles to its direction, each dragging a grapnel after her with a view to catching it.

It has been recommended to use for this purpose two fish-hooks (the hooks used in fishing the anchors), joined at the eyes, and kept apart, with their hooks in the same direction, by a few small battens lashed across their backs. It is dragged by the eyes, and kept with the bill of the hook downward by a back-rope, which should always be used on such occasions, in the event of hooking under rocks, &c.

When the chain is grappled, send out the launch and weigh it—hang the bight and drop the creeper down again, and so work till the end is reached, carry this to the ship, heave in, and heave up the anchor.

To sweep for an anchor, weight the bight of a line for some distance each side the middle, and putting an end in each of two boats, let them pull across the position of the anchor. A small chain is the best to sweep with.

The boats must be well apart, and the line dragging on the bottom. Sweep in the direction from ring to crown.

When the anchor is caught, cross the boats and haul up over it; drop the bight of a hawser down over the line so as to catch

WEIGHING ANCHORS BY BOATS.

over the upper fluke, slip an anchor-shackle down over both parts, to confine it, warp the ship up, take one end of the hawser to the capstan, clap a deck-tackle on the other, and weigh the anchor.

A running bowline may be slipped over the upper fluke.

TO WEIGH A BOWER BY MEANS OF A LAUNCH FITTED WITH TRUNKS.

Sweep the upper fluke with the bight of a hawser or piece of chain; having caught it, haul the rope the anchor is to be weighed with round the fluke, slip a shackle down both parts to keep it from coming off, pass the ends up through the trunk, bring to, and heave up.

When the crown is up to the boat, pass the end of the after-stopper from one quarter round the bow and aft the other side, let go the bight forward, and it will catch the shank of the anchor, hook on the luffs and heave the stock up; catch the chain in the same way, and heave it up to another boat.

TO WEIGH THE STREAM ANCHOR BY THE LAUNCH.

Ship the davit or roller in the stern, pass in the boat a couple of good luffs, selvagees, spun-yarn, and stuff for stoppers. Bring the cable over the roller, and clap on a luff, single block to ring bolt in the bows. Clap luff upon luff if necessary to break ground. If the anchor holds hard, heave to a short stay, getting the stern well down, and belay; then let all hands go forward and try to jump the anchor out. When all aweigh, clap the luffs on alternately, faking the cable in the boat.

When the anchor is up, hang it to the stern of the boat and pull on board.

CHAPTER XXXVIII.

HEAVING DOWN.

When vessels have sustained injury in their bottom, and there are no opportunities for docking, recourse is then had to heaving down. Tackles are brought from the mastheads to the shore, or to another vessel, and these being hove on, turn the bottom up out of the water.

The following notes were taken at the heaving out of the United States frigate "Brandywine," at the navy-yard, Brooklyn, in November, 1833; also at the heaving out of the United States schooner "Shark," at the same time and place.

United States Ship "Brandywine." The wedges of the fore and main masts were knocked out, and the masts got entirely over to the weather partners, the stays were also set up afresh, two extra pairs of shrouds were got over each masthead, and set up to dead eyes toggled with a long strap to the main deck ports. (These shrouds were taken forward of the masts so as to equalize the strain between the forward and after shrouds.) Two small chains were middled and eyes formed in the bights, which were well parcelled; one was put over the mainmast head, and the other over the fore; the ends were taken in through the air ports abreast the respective masts, and well set up to stout Spanish windlasses, which were rigged on the berth-deck in the securest manner possible; great care was taken that all the shrouds, extra shrouds, and chains, bore an equal strain.

Strong shores were placed against the heel of each mast, with their other ends leading up to the junction of the berth-deck beams to the side, where they were well wedged; these were to windward, and were to counteract the tendency of the heel going out of the step to windward when the strain of the purchases was felt to leeward; other shores had their upper ends resting against that part of the under side of the berth-deck, which is directly over the kelson; the lower ends rested on the skin of the hold to leeward about midway between the kelson and the ends of the berth-deck beams, where they were firmly wedged; these were to support the body of the ship when down on her side.

Five gammoning bolts, three and a quarter inches in diameter at the large ends, and two and a quarter inches at the small

HEAVING DOWN.

ends, were driven through the side of the ship abreast of each mast, about one foot above the berth-deck, and well secured at their inner ends.

The camels or bolsters (being large frameworks of timber to protect the channels from the heels of the shores, and strong enough to bear the strain), were hoisted up by the pendant tackles and strung abreast the masts to windward. The shores were of white pine, seventy-five feet long, nineteen inches square at the heel, and thirteen and a half inches at the head, with a mortice cut through at each end; two were used for each mast, and they were got aloft by having a large three-fold block lashed at the masthead, and a purchase rove of a five and a half inch manilla fall; the lower block was lashed to the shore about one quarter from the head, and thus each leg was hove up separately to windward; the masthead lashing was of new well-stretched four-inch rope, ten turns of which were passed through the mortice, *round and round*, and ten more *crossed*; the heel, resting over the camels were spread so that one might be as much forward as the other was abaft the mast, were gammoned to the bolts in the side with different sized white rope, after which the gammonings were well frapped together; three *spare shores* were lashed between the mast and each shore (making six for each mast), at equal distances, and belly lashings were hove on in the same places.

With so much weight on one side, the ship heeled considerably, to counterbalance which, water-casks were lashed on the opposite side, and filled, which brought her upright again.

A large and a small purchase were used for each mast; the large purchase-blocks were four and a half feet in length, the small ones two and three quarters; the upper blocks for the former were lashed to their respective mastheads, above the shores, with seven turns of a nine-inch manilla lashing, the upper blocks of the latter were lashed on with five turns of the same stuff; the lower blocks with their leaders strapped with a long and a short leg, and toggled to the spar in the pits.

Three crabs were placed for each mast, one for each purchase, the third as a backer for the large one; these crabs were secured to anchors planted in the ground, which were also assisted by pigs of iron.

An anchor, to which the stream cable was bent, was planted in the water abreast the mainmast, the cable opposite the fore purchase was secured to a pile at a convenient distance abreast the foremast; both cables were taken under the keel through the spar-deck ports, and stout tackles clapped on them; the breast

HEAVING DOWN.

fasts were slacked and the ship hove off a sufficient distance by the cable, after which all was secured.

A pair of small but stout sheers, with a figure-of-eight head lashing and head guys, were raised near each pit and relieving tackles attached to their heads; a relieving tackle was also hooked to bolts in the wharf opposite to each mast and then to the gammoning bolts; the falls were rove, and the ship was steadied by them and the relieving tackles.

All the ballast was now got out and placed over the spar which runs through the pits, and to which the lower purchase blocks were toggled; the berth-deck was scuttled abreast the main hatchway, to leeward, and pumps rigged there; the ship was caulked thoroughly, the lee gun-deck ports closed in and caulked also, together with the air ports and scuppers.

All moveables were passed ashore, and the falls rove, the large falls were of eleven-inch manilla rope, the small one of eight-inch manilla rope; the purchases were three-fold; saddles, with rollers, were placed under the falls from the leaders to the crabs, and every precaution taken to prevent chafe; a spar-maker was stationed at the partners when heaving, to see when and how much the masts came over; the main came to within two inches of the lee partners, and the fore touched gently. As the mast-heads got below the sheer-heads on the wharf, the relieving tackles from the sheer-heads were hooked to stout straps around the mastheads; when keel out, the falls were well stoppered and bitted to the crabs, the relieving tackles hauled taut and shores put under the mastheads to assist the relieving tackles; the purchase falls were well covered with tarpaulins.

Every night the ship was righted, and on Saturday night the falls were unrove; previous to her being hove down the next day, the frappings of the gammonings were always hove taut.

The starboard forward main swifter parted in heaving down the first time, which was the only accident which transpired. The ship was recoppered with eighteen hundred and ninety sheets of thirty-two-ounce, and eight hundred and seventy-eight sheets of thirty-four-ounce; total, twenty-seven hundred and sixty-eight sheets.

THE UNITED STATES SCHOONER "SHARK."—All the stores were taken out, and she was completely dismantled to the lower masts; gammoning bolts were driven into the side abreast the fore and main masts, to which two stout spars, running athwartships through the ports forward of each mast, were lashed down; these spars were also lashed down to others under the hatchways; the wedges of the masts were knocked out, the masts got

close over to the weather partners, and a weather shore lashed to each mast and the thwartship spar; the weather pendant tackles were also hooked to the same place and hauled taut. The purchase blocks went, with a long lashing, over the mastheads, and then all parts were frapped to the masts below the hounds; the lower blocks were toggled to the beams of the bridge dock, and pendant tackles were clapped on the falls of the purchases; relieving tackles were hooked from a pair of sheers and a crane on the wharf to the side, to assist in righting her. She was hove down, and the same precautions used as with the "Brandywine." The bottom was caulked thoroughly, and the same copper put on again.

In cases where the vessel has been dismasted, or where it would be impossible to procure sufficient length of purchase falls, &c., the bottom is turned out of the water by means of Spur derricks. H. M. ship "Success," for instance, was thus repaired. The upper ends of the derricks were cleated on the ship's side, the lower, to which the purchase blocks were lashed, were secured from rising by turns of the chain cable, that were passed under the bottom from the opposite side, being steadied by guys led from forward and aft.

The after bearings of the "Crœsus," a screw ship of twenty-five hundred tons, were, in the absence of a dock, recently repaired by means of a caisson, which, when placed, enclosed the heel of the ship from the foremost stern post aft.

It was formed sloping at the fore part from the base to the top, and sufficiently open at that part to admit the heel, the dimensions being twenty-two feet at base, fifteen feet at top, twenty feet in depth, and nine feet in breadth. Displacement about one hundred tons. It was sunk by loading it with chain cable, which was removed when the caisson was drawn forward into position by guys, and was kept free by constantly working two seven-inch pumps; the stern of the ship being raised in consequence nineteen inches.

DOCKS.

Ships are built or repaired, according to circumstances, on a slip, in a floating, or dry, or wet dock.

Where there is a regular and considerable rise and fall of tide, excavations are made in the land near the water, faced with solid masonry, and mostly having entrances fitted with gates or caissons, which serve either to retain or exclude the tidal waters as desirable. Those on a larger scale, and which are always kept full of water, are called wet docks or basins. These are, in

a Gun Deck .
b Berth " .
c Waterways
d Hanging Knees .
e Main Rail .
f Port Sill .
g Ships Frame .
h Wales .
i Diminishing Plank .

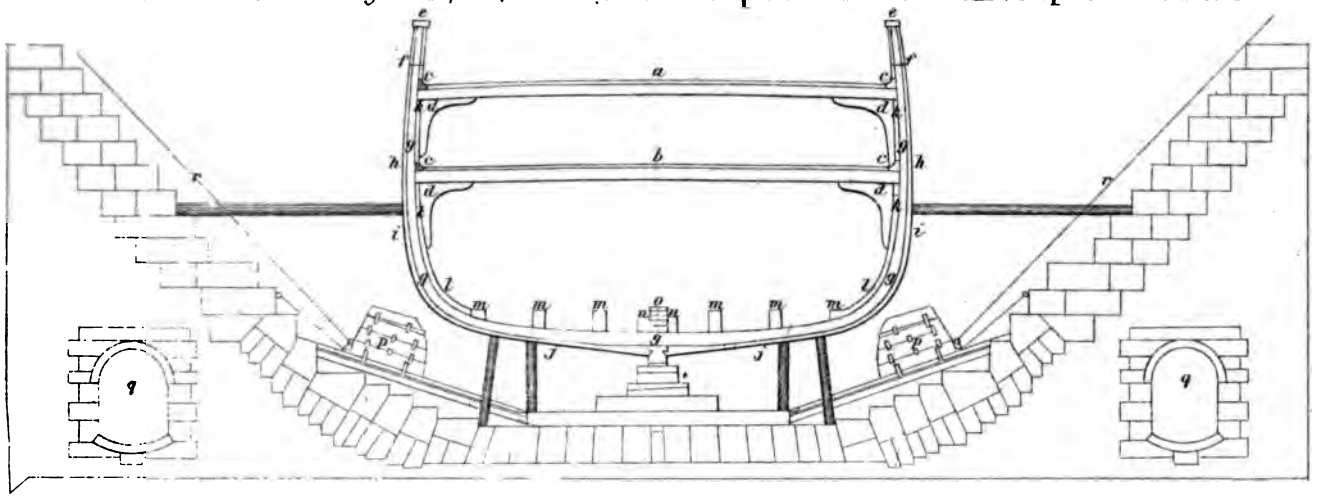
PLATE 88

THE DRY DOCK.

Fig. 417.

j Bottom Plank .
k Clamps .
l Bilge Strakes .
m " Keelsons.
n Sister " .
o Main " .
p Sliding Bilge Blocks .
q Culverts
r Line for hauling back Bilge Blocks .

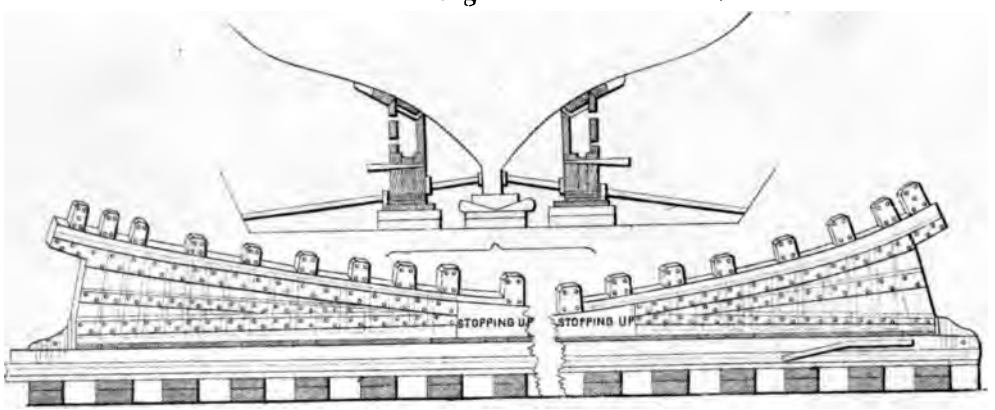
Section of the Dock at the Navy Yard N.York with the Midship Section of a Steam Sloop of War on the Blocks.



Scale of Feet and Inches

PLATE 89

Fig. 418.



DOCKS.

fact, artificial harbors, in which vessels are always kept afloat while undergoing internal repairs, loading or unloading, fitting for, or being kept ready for going to sea. Commercial wet docks usually have "locks" (as in a canal) attached to them, so as to admit of the entrance and egress of vessels at any time of tide without losing more water than necessary. In naval wet docks, the ships generally requiring as much water outside as in, one barrier in the form of a caisson is used, but which is seldom worked excepting at high water.

The Dry Dock is both deeper and narrower. It is deeper because it is necessary to have more water in the dock at the time of docking a ship than at its entrance. This is for the purpose of gaining depth enough for the angle blocks on which the keel of the ship is to rest, and is effected by having the floor of the dock somewhat below the low-water mark. Then, after closing the entrance, the dock is drained either by pumping, or letting the water run off with the falling tide through channels, called culverts. It is narrower, because when not water borne, the ship requires to be supported by shores; which, abutting on the sides of the dock, bear against those of the ship on being set taut by wedging. (Fig. 417.)

The Caisson, or Floating Dam, is a vessel whose length is equal to the breadth of the dock entrance. Both its ends are formed like the bow of a ship, and the keel is continued up each stem. It is ballasted and fitted with valves or penstocks, and so formed that when full of water and in its place across the entrance, the stem and keel fit accurately into a groove cut in the masonry on the sides and across the bottom of the entrance, the passage of water being thus prevented. When it is necessary to remove the caisson, the water is either run off at low water or pumped out; and as the entrance is widest at the top, the caisson, on being floated up on the rising water, becomes cleared of the grooves and is withdrawn.

The Slip is an inclined plane formed of solid masonry on the banks of a harbor or river, and carried out some distance beyond the low-water mark. Naval slips have flood gates. The ship's keel is laid on this on blocks, inclining to the horizon at an inclination of five eighths of an inch to a foot in her length. As the fabric rises it is supported by shores; and when the ship is completed, the cradle is placed underneath, and her weight by a process of wedging transferred to it. (Fig. 418.) When set close up in its place, this cradle fits like an outside framing of bottom timbers. It is supported by "stopping-pieces," and shores called poppets, resting upon sliding ways which extend along the slip in lines parallel to the keel. These ways are well soaped; all other sup-

ports and fastenings are knocked away, and the ship glides into the water. The cradle then disengages itself, and the ship is carried into the dry dock for the purpose of having such fastenings as were temporarily cleated on the bottom, for the top of the cradle to bear against, removed, and the process of coppering effected.

The Patent Slip is an adaptation of the common slip to the purpose of repairing vessels. Carriages in number according to the length of the vessel, fitted with cog-wheels and working on corresponding racks, are run out under the bows of the vessel. When secured upon these she is hauled up either by capstans or steam machinery.

The Graving Dock, according to naval distinctions, is open. In it vessels are grounded at high water, for the purpose of receiving trifling repairs on the fall of the tide. Before the introduction of copper sheathing, they were used for the purpose of breaming or cleaning the bottom by fires. In the construction of these docks, serious difficulties and great expenses are incurred. The soil may be so porous that the excavations may be swamped at every high tide, so rocky as to require the severest labor, or so soft that artificial foundations for the masonry have to be formed. They are also subject to the inconvenience of being dependent on tidal action and sufficient depth of water.

MODES OF WORKING SEVERAL GOVERNMENT DOCKS.

STONE DRY DOCKS.

Ascertain as nearly as possible the line of the ship's keel, then arrange the blocks in the dock to conform as near as may be to the line of the keel, always allowing the ship to settle a little in the centre. Let the ship be upright without heeling to either side; have the shores arranged on each side of the dock ready for use. Open the filling culvert gates, and when the dock is full, open the turning gates; haul the ship into the dock and shut the gates. Place the ship in the centre of the dock, start the pumps, and as soon as the keel touches the blocks, set up the horizontal shores by means of screws or wedges. As the water recedes from the dock, leaving the lower alters, other lines of shores must be placed and set up with wedges. As the water is pumped out, the alters should be washed off, that the workmen may have a clean dock for their operations. When all the shores are placed, and the ship properly secured, go to work.

DOCKS.

In docking large ships, such as heavy frigates and line-of-battle ships, it sometimes becomes necessary to stop the pumps for a few moments occasionally, in order to give the workmen time to get up a sufficient number of shores to secure the ship safely, which could not always be done with an ordinary crew of workmen, if the pumps were kept at full speed.

SECTIONAL FLOATING DOCK.

In the sectional floating dock, the stability of the structure is secured by end-floats, which slide up and down in framework provided for the purpose; they also serve the purpose of ballast for sinking the dock to receive a vessel.

When a ship is to be raised upon this dock, the water is let into the tanks, and the machinery put in motion, to raise the end floats, by which means the tanks are forced down to the proper depth to receive the vessel. The ship is then hauled in between the uprights, placed in the centre, and the end floats are let down so that the tanks rise gently until the keel touches the blocks; the side horizontal shores are then placed to keep the ship upright, and the pumps are put in motion. When the tanks begin to press firmly against the keel, the bilge-blocks are drawn under the ship, and the pumping proceeds until the ship is lifted out of the water, care being taken to work the pumps in the different sections in proportion to the displacement of the parts of the ship resting upon them.

If the vessel is to be taken on shore by means of the basin and railway, the next operation is to bring the bottoms of the tanks in a plane, which is done by heavy bed-screws applied to any tanks which may be higher than the others. These screws are set against the ship's bottom, and their effect, when turned, is to force the tank down deeper into the water. When all the tanks are so arranged as to present an even uniform surface to the floor of the basin, the structure is hauled into the basin, the valves in the tanks are opened and sufficient water is admitted to sink the dock and firmly ground it on the floor. The cradle is then placed under the ship, the hauling apparatus is applied, the engine put in operation, and the ship hauled ashore on the railway.

If necessary, the ship may then be shored, as on a building slip, and the cradle can be removed, so as to give the workmen free access to all parts of the keel and bottom.

DOCKS.

BALANCE FLOATING DOCK.

The balance floating dock is provided with side chambers intended to answer the same purposes as the end floats in the sectional dock; in these chambers are compartments, into which water is raised for the purpose of sinking the dock to receive a vessel.

If a ship is to be raised and hauled on shore by means of the basin and railway, the cradle is first put in the dock, the dock is then sunk by opening the valves, and by pumping water up into the upper side chambers; when sunk to a proper depth, the ship is hauled in over the cradle and placed in the centre of the dock, the water is then let off from the upper chambers, which causes the dock to rise gently until the keel touches the blocks, when the horizontal shores are placed to keep the ship upright. The pumps are then put in operation, and as soon as the ship has a good bearing on the cradle, the bilge-shores are drawn under her and all the water is pumped from the dock. The structure is then floated into the basin, water is admitted into the dock to sink it upon the floor; the hauling beams are now applied, the engine put in operation, and the vessel drawn on shore. As in the case of the sectional dock, if necessary, the vessel may be shored as on a building slip, and the cradle removed to give the workmen free access to the keel and bottom.

If the vessel is not to be drawn ashore by the railway, the cradle is not used in the dock, but the ship's keel rests upon blocks laid on the floor of the dock for the purpose. The process of raising would be the same as in the other case.

CHAPTER XXXIX.

MISCELLANEOUS NOTES.

FIRE-BOOMS, COCK-BILLING YARDS, DRESSING SHIP, ETC.

Precautions against Fire-Rafts. The following were adopted by the English fleet in the Canton river, 1856–7:

Ships off the factories, moored head and stern, were protected by a boom thrown across the river, above and below the position. The largest boom, above the factories, was formed of two layers of large spars, lashed together, with a stream chain laid between them, bolted to the spars on alternate sides, and the whole woulded round at intervals.

The spars were not placed so as to lock in throughout, but a small space was left every forty feet or so, to impart flexibility to the boom. At *c c* were two loaded sunken junks. At *b b* two junks moored head and stern, with long thirty-two's mounted forward, and guns' crews on board. At *a a*, two junks, to which was attached a small boom to screen the entrance.

The ships were fortified with a spar from each bow, meeting, and lashed together at the outer ends, and drooped by a tackle from the jib-boom end. Flying jib-boom kept in. From these outriggers, spars were continued aft to the gangways, supported by tackles from the lower yard-arms and boomed out by spars from the ship's side, which afforded space and shelter for the boats to lie within.

From the jib-boom end was suspended a fire grapnel, or a small anchor, shackled by a length of small chain to the riding-cable, outside the hawse. This was intended to drop into the fire-vessel, and anchor her by, on the cable being slipped and the ship dropping clear.

FIRE-BOOMS.

Over the stern, an anchor was hung, which, in the event of a fire-vessel becoming fixed to the bows, would, on being let go, and the lower cable slipped, bring the ship up by the stern, and throw the junk off.

As wooden tanks, containing upwards of a ton of powder floating at the water's edge, were occasionally sent down, the fire-booms were kept eased down, and floated on the water, and a guard-boat anchored ahead.

Destruction of Booms. Blow the boom up with powder; rouse up the bight of the chain; load with round shot a launch's gun; lash the chain across the muzzle; fire, and take advantage of the result. You may even fracture a chain in the same manner with a blank cartridge.

FIRE-BOOMS.

In 1809, a French fleet, under Vice-Admiral Allemand, was anchored in Aix roads, and disposed in the following manner: Ten sail-of-the-line were formed in a double line, nearly north and south, the outer line comprising five, and the inner six ships, including the Calcutta (an English prize), the inner line being so anchored as to face the openings between the ships of the outer line, the extremity of which was somewhat more than a mile from the batteries on the Isle of Aix. About half a mile in advance of the whole lay four frigates, ready to be employed as occasion might require, and immediately in front of these a boom of extraordinary dimensions. The boom formed two sides of a triangle with the apex towards the British fleet, under Lord Gambier, thus—

between its extremities being nearly a mile.

This formidable obstacle was composed of large spars, bound by chains, and moored along its whole double line with heavy anchors, at appropriate intervals, forming the most stupendous structure of the kind on record. In addition to this, the boats and launches of the French fleet, to the number of seventy-three, were armed and stationed in five divisions, for the purpose of boarding and towing off the fire-ships.

In this secure position, well might the French dress their fleet with flags and show their contempt for their assailants.

FIRE-BOOMS.

TO DESTROY A BOOM.

To Lord Cochran was intrusted the duty of destroying the French fleet (just mentioned), and a more judicious selection could scarcely have been made.

His first object was to destroy the formidable boom which shielded the French, and with that view he prepared, not fire-ships alone, which in this case would have been useless, but explosion-vessels also, the nature of which will be best understood from a description of one prepared under his own directions. The floor of the vessel was rendered as firm as possible by means of logs placed in close contact, into every crevice of which other substances were firmly wedged, so as to afford the greatest amount of resistance to the explosion. On this foundation were placed a large number of spirit and water casks, into which fifteen hundred barrels of powder were emptied. These casks were set on end, and the whole bound round with hempen cables, so as to resemble a gigantic mortar, thus causing the explosion to take an upward course. In addition to the powder casks were placed several hundred shells, and over these again nearly three thousand hand-grenades; the whole, by means of wedges and sand, being compressed as nearly as possible into a solid mass.

Such was the explosion vessel which Cochran himself conducted in on the dark and stormy night of the 11th of April. With fuses adjusted to burn fifteen minutes, they stood in to what was judged the proper distance, when Cochran kindled the port-fires, and descending into his gig, urged the men to pull for their lives; but having half a gale of wind in their teeth, and a heavy head sea, it can be conceived that their progress was not rapid.

Though arranged for fifteen minutes, the fuses lasted but little more than half that time, when the vessel blew up, filling the air with shells, grenades, rockets, spars, and masses of timber, and raising a solitary mountain of water, from the breaking of which in all directions, the gig narrowly escaped being swamped. But their very proximity proved their salvation, for the destructive missles and fragments of the vessel passed over them.

Of twenty fire-ships set adrift, four only reached the enemy's position, probably through mismanagement, and not one did any damage.

At daylight, on the morning of the 12th, not a spar of the vast boom was anywhere visible, and, with the exception of two, the whole of the enemy's vessels were hopelessly aground, having, in their consternation, cut their cables to escape the fire-

ships, which were all taken, most probably, for explosion-vessels.

COCKBILLING YARDS—MOURNING.

The most appropriate time for cockbilling yards seems to be daylight, and dark the most proper time for squaring them again.

At eight, or the hour of hoisting the colors half-mast, sway up the top-gallant yards, slip the lizard, parrel the yards, and cock-bill them with the others previously reversed.

To allow the lower yards to top up properly, the trusses must be slacked; and if the topsail sheets are of chain, and go with a whip, one of them must be unshackled from the clew, and to assist the lift in topping, a burton is required.

To allow the topsail yards to top up properly, they must be hoisted two feet or so off the caps, the parrels and braces must be slacked, and paunch mats taken out; if there are jaws on, slack the jaw-rope. Trysail and spanker gaff should be lowered well down, and swinging booms dropped into the water.

The way of topping the yards ought to be governed by the side on which the top-gallant yards are sent up; for instance, as the main top-gallant yard is sent up on the starboard side, the main and main-topsail yards should be topped to port. The squaring them, when topped, should be done with reference to lower yards; which, in the first place, are topped as high as the top rims will allow; then being squared by the braces, the top-sail and top-gallant yards have only to be parallel.

The lower yards top up better by the burtons alone.

DRESSING SHIP WITH FLAGS.

One mode of dressing a ship with flags is to make an arch of them from the flying jib-boom to the spanker-boom end; another is to trice the flags up by the signal halliards, stopping them out to the yard-arms; but the best way, perhaps, is to combine these two modes, if there be flags enough. Hoisted to the trucks ought to be the ensign, jack, or the flags of the nation in whose port the ship is lying, or which it is wished particularly to honor; and to give these room to display themselves the rest of the flags should only be triced as high as the top-gallant mast-head.

If it be determined to combine the two modes of dressing, as mentioned above, that is, with up and down flags, as well as

with an arch, it will prevent confusion and superabundance, and produce an equally good effect to have up and down flags at the main only; and to hoist them, whips or halliards should be placed for the purpose, through the top-gallant studding-sail halliard blocks, and taken *outside* the brace blocks.

The flying-jib halliards will hoist the foremost part of the arch, viz., that which extends from the flying-jib-boom end to the fore top-gallant mast-head. To the mizzen top-gallant mast-head it must be hoisted by a whip placed for the purpose, and hauled out to the gaff-end by a whip.

From the gaff-end the flags composing the arch drop to the water, being stopped out to the boom-end, and distended under it, as well as under the flying-jib-boom, by small hand-leads; there ought also to be downhauls on the arch; also whips with downhauls between top-gallant mast-heads. Care and taste are necessary in sorting and placing the flags. The ensigns should be in corresponding places—for instance, at the lower yard-arms. The square flags should all be together; also cornets, pendants, &c., or else a square flag and pennant alternately, and so on.

Bad feeling is sometimes occasioned, when foreign ships-of-war are assembled, by placing national colors injudiciously, in dressing ship. This ought to be studiously avoided. This fact has given rise to the practice, on "gala days," of hoisting nothing but the national flags at each mast-head, or, if in honor of another nation, the flag of that nation at the fore.

One principal beauty, however, of the manœuvre in question, is to have everything so prepared and foreseen, that immediately the yards are crossed, and decently squared, and the mast-head flags broke, all the others may be triced up so as to find their places readily and without confusion, hands previously prepared, laying-out together at the same time to each yardarm, stopping the up and down flag-halliards there; and then at the "word," laying-in *together*.

At sunset, the best way, perhaps, is to haul the flags down just before sending down the top-gallant yards.

Top-gallant yards are generally not sent down on the evening previous to dressing ship; but, should they be, cross them in the morning at seven bells. The flying jib and royal halliards are used to trice up by, rove through blocks at the mastheads, with downhauls attached; and the flags, in addition to being stopped at the head and tack, are stitched to the halliards amidships. Reeve them before breakfast, and bend the flags on; and at two minutes before eight trice up masthead ensigns, made up, and

SCRAPING SPARS.

send aloft the captain of each top and two hands, one of whom, going to the masthead, stops the tack in when broke; the other, remaining in the top, clears the flags, should they foul.

On a shift of wind, or at the turn of the tide if lying in a tideway, send hands aloft together to clear the flags.

SCRAPING AND GREASING SPARS.

When the blacking of the rigging is dry, the masts ought to be scraped and cleaned, then greased. For the men to stand upon when scraping the lower masts, rig triangles of capstan bars, with whips to the mastheads; for hoisting and lowering, with the topmasts, handspikes answer instead of capstan bars, and the royal and top-gallant masts may be managed from a bowline in the end of a girtline, or a span from shroud to shroud.

To prevent spotting the deck, the awnings ought to be spread, and some hands kept constantly sweeping up the shavings. It is a good plan, also, to wet down the decks and sprinkle them with sand, this prevents the grease or tar from striking in.

The top-gallant and royal yardarms should not be neglected. The studding-sail booms, except when new, ought to have the least possible shaving taken off them by a carpenter, and then varnished. This does not injure them more than scraping, and keeps them infinitely smoother.

Before laying on the grease, the captains of the tops, &c., should report that everything is scraped and ready, and the boatswain should examine.

NOTE. It is customary in some ships first to scrape masts, then tar down the rigging, and lastly paint; but there is objections to this, as the men are liable to daub the masts when tarring down, and they would have to be done over again.

Studding-sail booms should never be greased, as they are liable to daub the sail.

MANNING YARDS.*

If previously aware that the yards are to be manned in the course of the day, clap on life-lines instantly; the top-gallant and royal yards are crossed in the morning, the hands laying out and in together; then square yards.

* See Navy Regulations.

MANNING YARDS.

Fewer men being required for manning yards than furling sails, those required for the former may be easily sized and *selected* from among the latter, keeping them always on their respective yards—the tallest outside.

The yardarm men extend their outside arms straight, holding on by the studding-sail halliards, while they clap their inner arms over the life-lines, holding it fast under the arm-pit; the next man in the same way extends his outer arm, and grapples the shoulder of the yardarm man; then passes his inner arm over the life-line, clasping it under his arm-pit, and so on to the bunt.

The appearance of the boat, at whatever distance it may be, is the customary signal for manning yards; yet it would be at times a preferable rule to endeavor to judge of the distance, and act so that the men may not be more than ten minutes or a quarter of an hour aloft.

The men on the yards ought to face the boat; that is, when the boat is abaft the beam, they ought to face aft; when before the beam, forward; but in a ship, when the person saluted ascends the side, the hands on the cross-jack and mizzen topsail yards ought to face forward—all others as before, aft.

On a station where manning yards may be frequent, a regular station-bill should be made out.

DAILY ROUTINE IN PORT.

The following may serve as a basis, upon which to model such a routine as circumstances and the class of vessel may require:

I. At early daylight beat the Reveille and call all hands.

II. Stow hammocks, allowing 10 minutes.

III. Go to breakfast for 45 minutes.*

IV. Turn hands to and sweep down.

V. Pump out ship.

VI. Execute morning orders.

(The master-at-arms to inspect boys and servants.)

* This contemplates an early breakfast before wetting the decks—a plan recommended for warm weather.

DAILY ROUTINE IN PORT.

VII. Lower boats together, stopping up falls neatly.

VIII. Wash ship outside and clean copper.

IX. By fifteen minutes to eight bells the crew to be dressed uniformly.

X. Clean bright work.

XI. On hoisting colors, loose sails, when so ordered, and cross top-gallant yards.

XII. Square yards and haul rigging taut.

XIII. Flemish rigging down.

XIV. In suitable weather, spread awnings and roll back hammock-cloths.

XV. At 9 A. M., (Sundays excepted,) beat to quarters, inspect crew in clothes prescribed for the day, and exercise according to Routine table.

XVI. Mechanics and working gangs proceed according to orders.

XVII. The deck board will show the hours established for boats to leave the ship.

XVIII. At 11.30 A. M., furl sail, pipe down washed clothes, or hammocks, if dry, and clear up decks.

XIX. At 12 o'clock, pipe to dinner. (Pipe up mess traps 5 minutes before each meal.)

XX. At 1 P. M., turn the hands to.

XXI. Mechanics and gangs proceed to work.

XXII. At 4 P. M., clear up decks, and lay up the rigging.

XXIII. At 5 P. M., pipe to supper, (men shift in blue.)

XXIV. At 5.30, turn the hands to.

XXV. At 10 minutes before sunset, beat to quarters and inspect the crew in their woolen clothes.

XXVI. At sunset, hoist boats and send down top-gallant yards.

XXVII. Pump the ship out.

XXVIII. At 7 P. M., pipe hammocks down.

DAILY ROUTINE AT SEA.

XXIX. At 9 P. M., the boatswain will pipe down and the master-at-arms will report to the officer of the deck that the crew are in their hammocks.

DAILY ROUTINE AT SEA.

MORNING WATCH.

I. After the first essential duties of the watch are done, lay up rigging and wash or sweep decks.

II. Scrub clothes, except on Saturdays.

III. Pump the ship out.

IV. Clean decks, according to morning orders.

V. At 6 bells, call all hands and pipe hammocks up, allowing 10 minutes.

(Master-at-arms inspects boys and servants.)

VI. Clean bright work.

VII. Call guns' crews to quarters, rub off the guns, and clean arms.

VIII. Stow pea-jackets in bags, and roll back hammock-cloths.

IX. At 7 bells pipe watch below to breakfast.

X. At 8 o'clock, pipe watch on deck to breakfast.

FORENOON WATCH.

I. At one bell, turn the hands to.

II. At 9, beat to quarters, and inspect arms and the crew in clothes prescribed for the day, except on Sundays, and commence exercises according to routine.

III. Mechanics go to work according to orders.

IV. At seven bells, pipe down washed clothes, and clear up decks.

V. At 12 o'clock pipe to dinner, one watch at a time.

AFTERNOON WATCH.

I. At two bells, turn the hands to and commence the prescribed exercises.

WEEKLY ROUTINE.

II. Mechanics resume work.

III. At seven bells, clear up decks.

IV. At 4 o'clock, pipe to supper, one watch at a time.

DOG WATCH.

I. At two bells, turn the hands to.

II. At ten minutes before sunset, beat to quarters and inspect the crew in woolen clothes, and with their pea-jackets.

III. Pump the ship out.

IV. At sunset, pipe hammocks down.

V. At 8 o'clock, set the night watch.

WEEKLY ROUTINE.*

I. On Sundays, muster at quarters at 10 o'clock, and perform Divine Service.

II. Mondays, Wednesdays, and Fridays are washing days in port.

(In some squadrons the order is Tuesdays and Fridays.)

III. On Monday morning, the yeoman's weekly report is due.

IV. On Tuesday, air bedding, overhaul buckets, &c.

V. On Friday, sweep the galley-funnel, whitewash berth deck, and scrub mess cloths.

VI. On Saturday morning, holy-stone all decks.

VII. After quarters, pipe up all bags and mend clothes.

HALF-MONTHLY ROUTINE.

I. On the first and third Mondays, scrub hammocks and cots.

II. On the first and third Fridays, scrape masts and booms and grease hide-ropes, overhaul blocks and sheaves.

III. On the second and fourth Saturdays, air clothes, scrub wind sails.

* Every steam vessel should have a special regulation in regard to the periodical cleaning, reporting, and inspecting of the bilge.

MONTHLY ROUTINE.

I. On the first week day, officers of divisions inspect clothes, see them properly marked, and make out requisitions, and clothes-lists.

II. On the first Sunday,* general muster; read "Act for the better government of the Navy," internal rules and regulations of the ship, and inspect the crew.

III. On the 15th, paymaster to issue small stores, on approved requisitions.

IV. On the last day of the month, master's mates and midshipmen of watches exhibit journals to the captain, and copies of watch and quarter-bills to the executive officer.

V. On the first day of the month, the master-at-arms will send in to the captain the monthly return of prisoners, offences, and punishment.

BIMENSAL ROUTINE.

I. On the first week-day of every second month, the paymaster will make returns of deaths, desertions, enlistments, transfers, &c.

QUARTERLY ROUTINE.

I. The gunner will make a return of expenditure of ordnance, equipments, and stores in his department, and will also report to the captain the condition of the arms and ammunition.

II. The yeoman's quarterly account of expenditures is due on the first week day of the quarter.

III. At a suitable time in the quarter, overhaul cables and shot.

---

* This is an old custom of the service, and one which may be "more honored in the breach than in the observance," by giving the preference to some other day of the week.

DIVISIONAL ROUTINE.

DIVISION.	MONDAY.	TUESDAY.	WEDNESDAY.	THURSDAY.	FRIDAY.	SATURDAY.
1st division..	General Quarters.	Rifles.	Great Guns.	Fire Stations.	Single Sticks.	Mending Day.
2d division		Great Guns.	Rifles.	"	"	"
3d division..	"	Rifles.	Single Sticks.	"	Great Guns.	"
4th division.	"	Great Guns.	"	"	Sharpe's Rifles.	"
5th division ,	"	Single Sticks.	Rifles.	"	Great Guns.	"
6th division..	"	Carbines.	Single Sticks.	"	Carbines.	"
7th division..	"	"	.....	"	Single Sticks.	"
Marines....	"	Company Drill.	Great Guns.	"	Company Drill.	"

HOWITZERS AND BOAT DRILLS,
on Thursdays, after Fire Stations.

LIST OF CLOTHES EACH ONE OF THE CREW IS REQUIRED TO HAVE.

2 Caps. One of which will be a mustering cap.
3 Cap Covers (white).
1 Black silk neck handkerchief.
3 Blue flannel overshirts.
3 Undershirts.
3 Drawers—if worn.
1 Pair blue cloth pants.
2 Pair satinet "
3 White frocks.
3 Pairs white pants.
2 Pairs of socks.
2 Pairs of shoes.
1 Flannel Jumper } will be worn when the word is passed,
1 White Jumper } they are not to extend below the hip and will have the usual badge and watch mark on.
Badges as per regulation.
1 White straw hat.

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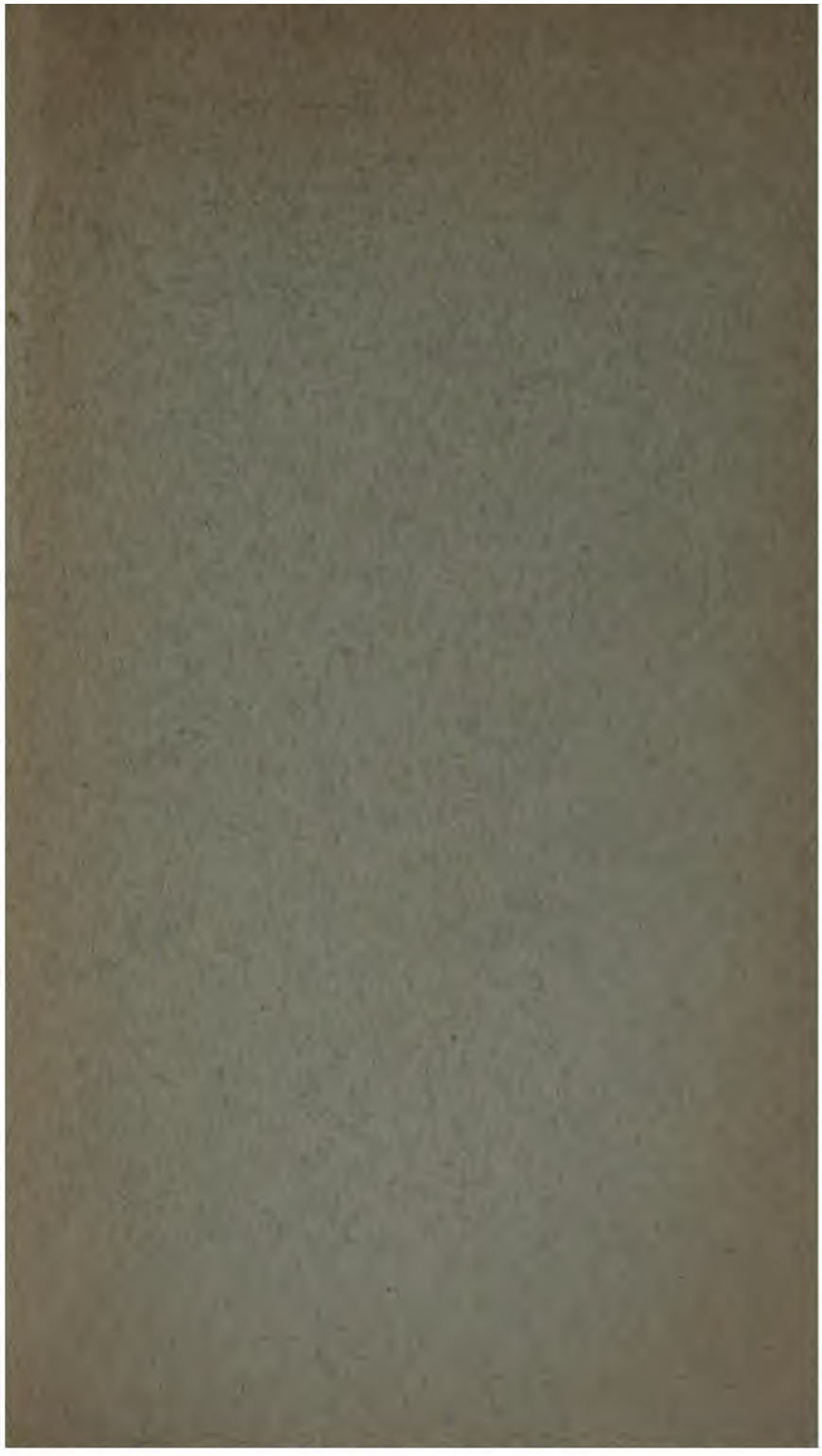

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